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Developing the Latent Market

Even a superficial examination of electrical conditions in any community will reveal the fact that a considerable portion of the population do not enjoy any of the advantages of electric service, and of those who do only a very small percentage enjoy them to the full. This indicates that there is an immense load still to be had and that, ignoring entirely future developments in the art, the electrification of railroads and of industries not yet won over to electrical operation, the saturation point is so very remote that no account need be taken of it. The stability of electrical investments and the vast amount of new capital that is being poured into the industry, used as rapidly as it can be raised, and limited only by the cost of money, reflect this favorable condition. With a view to stimulating the demand for electricity on the part of the general public and of educating those engaged in electrical work to the great opportunities incident to a harmonious and co-operative movement, the Society for Electrical Development was organized more than a year ago. Its plans have been outlined in our columns from time to time and are again set forth in the present issue together with indorsements from men prominent in the industry. In order to commence its work, the society asks from an industry representing an invested capital of at least $2,500,000,000 the modest sum of $200,000. Thus far it has been able to raise about $170,000, and, be it said to the detriment of that branch of the industry which is destined to reap the greatest ultimate reward from the movement, the central stations have not supported it as liberally as their relative financial strength warrants. There has been a tendency in central-station circles to regard the movement as utopian; but judgment should not be rendered without a fair trial, and the amount of money involved is not so large that the experiment, if it be so regarded, cannot be tried for a year at least. A similar movement has met with marked success in less progressive Germany. The publicity campaign of the Electric Vehicle Association of America, affecting only a small branch of the industry, has shown results sufficient to justify a continuance of the work, and now the National Commercial Gas Association, with prospects less promising, is raising a fund of $300,000 for general educational purposes, half of which sum has already been subscribed. It would be a reflection on the entire electrical industry to permit this great co-operative movement to die without giving it a chance to justify its existence. What appears more visionary to the prospective user of electricity than the claims of exponents of central-station service, and yet are not all the claims substantiated when the actual installation has been made? "Do it electrically" is what the central stations of the country preach, and "Do it electrically" is the motto of the Society for Electrical Development. If the work of that society is to be done at all, it should be done at once, and it can be done at once if the central stations of the country join the movement. It is certainly worthy of their support, and that support should not be withheld with the goal so near at hand.

The Tallulah Falls Plant

This important hydroelectric station, described in this issue, is noteworthy as being the only large development at really high head east of the Mississippi, if one excepts Niagara, which can hardly be placed in the high-head class. Six hundred feet of head is rather unusual anywhere, and to find a large installation working at this head in the southern Appalachian country is somewhat impressive even in these days of big plants. The present installation consists of five 17,000-hp turbines, each connected to a 10,000-kw generator. The general construction of the system is that typical of the development of high heads, except that advantage was taken of the topographical conditions to build a 110-ft. dam above the natural falls of the stream. Below the dam is a tunnel cut-off nearly a mile and a quarter long, terminating in an artificial forebay of concrete and steel, from which drop five 60-in. penstocks, a little over 1000 ft. long, to the wheels below. The hydraulic conditions therefore are quite unusual, owing to the desirability of adding to the head by an exceptionally high dam, and to the contour which brought about the tunnel construction and the artificial forebay. At the power house, too, are to be found some unusual features. The use of Francis type turbines for this head is rather exceptional, but it is advantageous on account of the great size of the units and the gain possible by giving them exceptionally high rotative speed. Probably impulse wheels would not have proved so suitable on a 10,000-kw scale. Another interesting feature of the plant is the storage pond and its appurtenances. The location where the reservoir could be most conveniently formed was about 6 miles above the head-works, where a 90-ft. dam was thrown across the stream capable of impounding more than 1,000,000,000 cu. ft. of water. This pond renders available, when it is drawn upon, a considerable power, and the plans include an auxiliary plant at this point containing two 3000-kw units to utilize the water drawn from storage and transmit the energy to the main line below. At the main dam provision has been made for keeping the head constant during floods by the installation of ingenious automatic swinging flashboards controlled by counterweights so as to hold the elevation of the pond back of the dam practically constant. During the period of construction

a temporary hydraulic plant with a 40-ft. head constructed below the site of the main dam was utilized for working the air compressors. Taken altogether, the hydraulic arrangements of the plant are of exceptional interest and the electric system will make an addition to the list of really high-voltage plants, since the transformers are designed to deliver energy to the line at 110,000 volts. The generators are on vertical shafts with the weight carried in suspension from oil pressure bearings at the upper end of the shaft, an arrangement which is particularly good from the standpoint of easy inspection of the bearings.

Regulation by Counter-Emf Cells

A brief article in our columns this week describes a very interesting application of counter-emf cells on a large scale for storage-battery regulation. Ordinarily central-station storage batteries are regulated by the use of end cells in such number as may be necessary. This method is altogether effective, but it is open to some practical objections chiefly by reason of the considerable complication in the switching apparatus and the extra care needed on account of the fact that the end cells are ordinarily at different stages of charge from the main battery, and hence may require special attention. The present arrangement works on the principle of holding the electromotive force steady at any necessary point below its maximum value by inserting the requisite number of counter-emf cells. These are built up out of unformed lead plates in the usual battery tanks with the ordinary electrolyte. When such a cell is put in circuit with the main battery it begins to form, thereby setting up a counter-emf which lowers the battery terminal voltage by the amount of its charging voltage.

In the installation described twenty-four counter-emf cells furnish the necessary amount of regulation for a 150-cell battery of large storage capacity. Regulation is secured by short-circuiting the necessary number of these cells, the result being a momentary heavy rush of discharging current in the local circuit which dies away almost instantly from lack of energy storage behind it. It is found in practice that the counter-cells never form fully enough to discharge an embarrassingly large amount of energy. Most of the energy lost seems to be spent on the electrolyte, and its total amount is small since the battery is used only for relief in emergencies and the counter-cells are out of circuit both when the battery is charging and when the heaviest demands fall upon it. The main battery is thrown upon the system automatically when the voltage falls too low, and the counter-cells at this time form a useful cushion to prevent too sudden a rush of current if the voltages of the system and the battery are undesirably far apart. For this particular sort of use the counter-emf cells seem excellently adapted, and the simplification of the switching arrangements over those necessary when end cells are employed in the ordinary way is very noticeable. Not the least of the advantages of the scheme is that every cell of the working battery is kept at the same stage of charge, since the whole battery charges and discharges together. The counter-emf cells, too, are practically fool-proof and almost indestructible.

Appliances as a Source of Revenue

We have published from time to time reports of the progress which has been made in the exploitation of heating and cooking apparatus and the like, and scarcely an issue passes in which some new application of electricity to the service of the average man, or some new device for accomplishing a useful end, is not described. In spite of all such evidence of activity, the fact remains that these miscellaneous uses of electricity, really of direct importance to the householder as well as to the central station, have not advanced with the rapidity which might reasonably be expected. Just what the obstacles are is not altogether easy to ascertain, but in looking over the field it seems most probable that the main trouble is lack of realization on the part of the central station that a great field for the sale of energy is ready to be opened. Appliances by many makers are available. Most of them are good and some of them are both cheap and good. Campaigns of education have been liberally carried on, frequently with somewhat disappointing results, occasionally with fair returns.

Some light may be thrown on the situation here by turning a little attention to the work recently done in and about London, of which many reports have been published in the English papers within the last year. Many thousand kilowatts in appliances have been placed in service within that time, and some definite information is accumulating as to the nature of the load and the possible revenue. Experience seems to have shown that once a customer uses such appliances the income received from him for such work, even at British prices, rises to a considerable fraction of that of the lighting revenue from the same customer, and it has been found that the only added expenditure in most cases is a possible increase in the size of meter. Now and then, of course, when an exceptionally large number of appliances must be installed the service equipment must be increased, although the British experience, like most of that here, indicates that appliance load is mostly, sometimes entirely, off the peak. The exact distribution of such load varies with the character of the community served, but there seems to be a tendency toward a large improvement in the diversity factor, so far as the evening load is concerned, so that while appliances may and do produce a very noticeable effect at certain times of the day, there is very little tendency to raise the main afternoon peak. The British experimenters openly say that there is a first-class lucrative field in appliance work even at very low prices, owing to the fact that it thus utilizes the whole generating and distributing system more efficiently.

The main feature of the British campaign for business has been the establishment of a very low secondary rate for appliance load, a rate varying in different stations from 4 cents down to as low as 1 cent per kw-hr., generally being from 2 cents to 3 cents. The primary charge is a demand charge of one sort or another, generally estimated with a somewhat liberal concession to the consumer, although in many cases nominally rather high. The chief point is that the secondary rate is so adjusted that the small consumer gets the benefit of it for this particular kind of load. Many of the secondary rates charged in America are nominally low enough to encourage electrical heating

and cooking, but with rare exceptions they are so adjusted that only the very large consumer gets the slightest benefit from them. The theory upon which the British manager keeps down his secondary rate is substantially that the business is profitable even at this low rate by reason of the nature of the load on the generating and distributing system. In more than one of the stations about London gas ranges and gas heaters have been driven out in considerable numbers and the appliance load as a revenue winner is firmly established. With proper cultivation of the field equally good results should follow here, because, while the small area of distribution covered by most of the British plants and the advantages of cheap coal and labor tend to keep rates down as compared with those current here, yet, on the other hand, the British price for gas is generally astonishingly low compared with the price charged in this country, so that the chance for competition here is at least equally good and probably better.

Wanted: Legislation to Promote Business

The Secretary of Commerce has added his recommendations to the already large mass of suggestions for legislation on business. The Attorney-General complains that violations of the anti-trust law are being reported constantly. The Postmaster-General announces that he and President Wilson have discussed with open minds the question of ultimate federal control of telegraph and telephone lines. A few days later his annual report urges it. A member of the Interstate Commerce Commission expresses his opinion to the effect that if increases in railroad rates are allowed there ought to be concurrent legislation giving the commission control over security issues in order to insure proper financing. Where will these proposals lead? Consider what a few of them mean. Take only one or two of the points advanced by the Secretary of Commerce. He would have a law providing that there shall be a presumption that all restraints of trade are unreasonable and that the reasonableness of a restraint must be established by the party exercising it. That is to say, every restraint would have to be justified. This raises the question of what would constitute a restraint under such a law. Suppose a manufacturer finds that there is serious overproduction in his industry. Temporarily production has passed far beyond consumption. He either reduces the output of his factory or closes down entirely until the consuming demand again justifies greater production.

Would the Secretary classify reduction in production as restraint of trade? To what expense would his law automatically put the manufacturer who wanted to obey it? Necessarily the government would be required to provide an agency before which the plea of the manufacturer would be made. Thousands of cases would clog the machinery of this agency, whether it was a court, a commission or a member of the President's Cabinet. Instead of the expedition that ought to promote trade there would be delay to hinder it. This is a very cumbersome method and unreasonably restrictive. Instead of the presumption that all acts of a restrictive nature are unreasonable there should be a sharp definition of many acts that are not unreasonable and that any fair-minded governmental agency would so hold. This would be consistent with the desire expressed by President Wilson to "reduce the area of debatable ground" created by the Sherman law. Since the suggestion of the Secretary of Commerce would fail to clarify the outlook and appears to be inconsistent with the wish of the President to "relieve business of uncertainties" and provide "a clear path" which business men "can travel without anxiety," we are led to the conclusion that the real ideas of the administration are not yet ready for announcement.

Another suggestion of the Secretary of Commerce is that $431,000 be appropriated for an investigation to determine whether or not large combinations make for efficiency; in other words, whether many small units render better service than a few large units. The humiliating experiences of the government in undoing some large industrial combinations ought to prove that uneconomic steps are either futile or dangerous. There are weak and inefficient forms of large business as well as of small business. Size alone is not the test. If this large appropriation could be granted and then used to promote business instead of to investigate it, the results would be practically useful instead of academically or doubtfully useful. The outspoken views of the Postmaster-General in regard to government ownership of telegraph and telephone lines are met by a calm expression of confidence by Mr. Vail. The unfortunate feature about the matter is that stockholders cannot feel happy over declines in securities. They become frightened and sacrifice securities on a declining market.

Consideration for unfortunate stockholders ought not to be outside of the fair duty of government officials. But with them free speech is free speech on matters vitally affecting others. The cost is nothing to them, it is the concern of others. The utterances of both the Postmaster-General and a member of the Interstate Commerce Commission have accentuated the present distressed investment situation in New England. Investors there have been hard hit. This is not the time for government officials to wave their personal flags. It is the time for them to labor for confidence. The mistakes that were made in New Haven policies have imposed heavy penalties upon those who were least able to bear them. The time is here now for healing, corrective steps. What we need most is legislation to promote business. What we do not need is legislation to hamper honest industry in its aim of production at a fair profit. Every act that hinders business is a double handicap in these times. Every act that promotes business has a contagious influence on the hopes of others. It would be a wholesome relief to read more in governmental bureau reports and utterances about ways to develop business and less about ways to prevent business. Instead of tearing down what it does not like, let the government say what it does like and alert and enterprising men will seize the chance to build up from that. We do not want hampering legislation and policies that close the door to development and stifle industry. We do want constructive legislation and policies that open the door to progress and prosperity.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Interlocking Directorates Not Illegal

Judge Windes, of the Circuit Court of Cook County, Ill., refused Tuesday to grant a temporary injunction sought to restrain the so-called interlocking of directors in the Commonwealth Edison Company and the People's Gas Light & Coke Company, of Chicago. The petitioner, Mr. James J. McCarthy, president of the Chicago & Cleveland Car-Roofing Company, and comparatively a small stockholder in the gas company, complained of interlocking as shown by the service on the gas board of Messrs. Samuel Insull, James A. Patten and John J. Mitchell, directors of the Commonwealth company. Judge Windes found that there was no allegation that showed fraud or injury to the complainant. The judge said that it is certainly the duty of the directors to do what is best for all the stockholders of a corporation, but if there is absence of fraud and the directors are doing what they think is best for the majority of stockholders, the mere fact that one small stockholder may be injured does not justify the court in restraining the directors as asked by the petitioner.

Problems in Electrolytic Deposition

The regular monthly New York meeting of the American Institute of Electrical Engineers for Jan. 9 will take the form of a joint session with the American Society of Mechanical Engineers and the American Electrochemical Society, at which the topic of discussion will be "The Power Problem in the Electrolytic Deposition of Metals." President C. O. Mailloux of the Institute will preside, and the following papers will be presented: "Limitations of the Problem of Electrolytic Deposition," by Mr. Lawrence Addicks, superintendent United States Metals Refining Company, presenting a brief statement of the conditions imposed by practice in the electrolytic refining of copper as a typical process; "The Mechanical Side of the Problem," by Mr. H. E. Longwell, mechanical engineer Westinghouse Machine Company, dealing with the application of gas and steam prime movers for driving generators of the type required, and "Sources of Direct Current for Electrochemical Processes," by Mr. F. D. Newbury, Westinghouse Electric & Manufacturing Company, covering the design of electrical machinery for high-speed generation of the large currents required in electrochemical work. The papers will be illustrated. Following the joint session those in attendance will be the guests of the Institute at a smoker to be held in its rooms on the eleventh floor of the Engineering Societies Building.

Large Connecticut River Development Foreshadowed

The Northern Connecticut Securities Company, controlling electric-lighting properties in Windham and Tolland Counties and the United Light & Water Company, of Waterbury, New Britain, Greenwich, Norwalk and vicinity, has purchased the water rights of the Connecticut River Company at Windsor Locks, Conn., and plans to develop 30,000 hp if the approval of the federal government can be obtained. A large dam is to be built across the river with a lock installation which will permit navigation of the stream to Springfield and possibly Holyoke. The Connecticut River Company, organized in 1828, has developed 3500 hp at Windsor Locks. The estimated cost of the proposed hydroelectric development is about $5,000,000. A bill has been introduced into Congress by Representative Gillett authorizing the building of the dam. About twenty similar bills are awaiting attention at Washington, the Connecticut River measure being first on the list. The policy of the government in relation to the Windsor Locks development will in large degree forecast the future of hydroelectric undertakings on navigable streams of interstate character.

Salaries for Ontario Hydro-Electric Power Commissioners

At the annual general meeting of the Ontario Municipal Electric Association, held in Toronto Dec. 9, a resolution to the effect that the Hydro-Electric Power Commission be authorized to set aside from the funds of the municipalities a sum not exceeding $25,000, to be paid for management and operating expenses, was passed. The matter has been laid before the Premier, the suggestion being that, in addition to the amount paid from public moneys to the chairman of the commission as an honorarium, a sum not exceeding $25,000 be authorized by the municipalities to be paid from the funds of the undertaking to remunerate members of the commission. It was stated that the enterprise, having passed the organization and construction stages and being now established as an operating and going concern cannot expect to get the particular and skilled attention and management to which it is entitled without paying for it something approaching the salaries which are offered by the large private corporations.

New York Safety Exposition

The first International Safety and Sanitation Exposition was held from Dec. 11 to Dec. 20 at the Grand Central Palace, New York, under the auspices of the American Museum of Safety. A number of the exhibits were of electrical interest, and all of them showed how some employers are continually devising means for safeguarding their employees. Notable among the displays was that of the Pennsylvania Railroad. Numerous small and simple devices, such as wooden pliers for pulling fuses, hangers for lamps, safety locks for automatic elevators, etc., that have proved their value in preventing accidents were shown. A section of single track with third-rail and overhead signal bridge was also exhibited. Models of a prostrate man and an attendant, showing how a pulmotor is operated, were a feature of the New York Edison Company's safety exhibit. The Westinghouse Electric & Manufacturing Company, the General Electric Company and the Benjamin Electric Manufacturing Company had machines fitted with safety devices operated intermittently during the display. The exhibit of the Illuminating Engineering Society attracted much attention. It consisted of a number of miniature rooms and lighting installations, showing correct and incorrect methods of illumination. The New York Telephone Company's exhibit was made up of several switchboards and a model

of New York City and vicinity. The object of the display was to show how a message would be sent from Arlington, N. J., to the Schuyler exchange in New York.

To Prevent Conflicts in Dates of Societies' Meetings

The secretaries of seventeen American engineering organizations held a meeting in the Engineering Societies Building, New York, on Saturday, Dec. 13, to discuss plans for the prevention, so far as possible, of the setting of the same dates for important meetings of different associations. Engineers do not need to be reminded of the necessity for some good get-together work along this line. Some overlapping is unavoidable, but in the future a concerted effort will be made to avoid simultaneous sessions wherever possible, and it is certain that the engineering body generally will be keenly appreciative of whatever measure of success is achieved. The seventeen executives at Saturday's meeting represented a collective national membership of more than 100,000 engineers, engaged in various branches of the engineering profession, all more or less correlated—gas, electric, mechanical, civil, illuminating, mining, marine, etc. Preliminary measures were discussed, and it is probable that by an early date the scheme will take more definite shape in the formation of a society of the executive secretaries of the national engineering associations.

Mr. Tripp on Business Conditions

A statement on business conditions written by Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, was published in the New York *Sun* on Dec. 15. Mr. Tripp said:

"The operations of the tariff for the last two months do not indicate that any serious inroad upon profits is to be expected to result directly from the reduced duties. The product of our company is generally of a highly specialized character and particularly adapted to the demands of the service in this country, with which we are far more familiar than German and other foreign competitors. Further, we are on this side constantly expending a great amount of money in developing improved and more efficient types of apparatus, and in general it is safe to say that the United States leads the world in the electrical manufacturing industry. I doubt, therefore, if foreign competition will be able and can afford to keep pace with our development work.

"While in my opinion the electrical manufacturing business will not be adversely affected directly to any serious extent by the reductions in the protective tariff on articles of its manufacture, it should be borne in mind that other lines of business may be seriously affected thereby, and that a diminution of business in any substantial industry will of necessity react on all other enterprises."

1914 Meetings, Pittsburgh Section, I. E. S.

The advance program prepared by the Pittsburgh Section of the Illuminating Engineering Society for its 1914 meetings includes the following:

On Jan. 16 Messrs. E. B. Rowe and H. H. Magdsick, of Cleveland, Ohio, will present a paper entitled "A Photometric Analysis of Diffusing Units with Varying Indirect Components," and Messrs. A. B. Wilson and F. J. Blaschke, of Cleveland, Ohio, will discuss "The Relation of the Engineer to the Problem of Fixture Designs."

On Feb. 13 Messrs. A. C. Cotton and Harold Kirschberg will present a paper on "Railroad Yard Illumination, Including Truck Scale and Classification Yard Lighting."

On March 13 Mr. S. B. Stewart will speak on "Modern Gas Lighting."

On April 17 the subject to be presented by Mr. C. E. Stephens, Pittsburgh, Pa., will be "The Development of Flame-Type Carbon Arc Lamps."

On May 15, the last meeting of the season, Mr. Ward Harrison will discuss "The Illumination of Building Exteriors."

Oldfield Patent Infringement Bill

Mr. William A. Oldfield has introduced in the House of Representatives a bill relating to patents, with special reference to infringement procedure. According to the bill, which has been ordered printed, the plaintiff charging infringement shall make a prima facie statement showing title and infringement, whereupon the court shall enter an interlocutory order directing that the defendant shall (a) file with the plaintiff each month a statement of the number and selling price of the devices made, sold or used by the defendant until the final decree in the suit, and (b) shall at the same time pay to the plaintiff a royalty of 5 per cent of the total selling price so reported. If the selling price be not established, or at its own discretion, the court may fix an arbitrary price as a reasonable selling price.

When such application has been made by the plaintiff and the statements are filed and royalty paid by the defendant, the defendant shall not thereafter be required to account for or pay any other profits or damages for any infringement so reported and paid for, nor shall any injunction be issued against the continued use of the specific infringement so reported and paid for. No defendant shall be required to pay more than 5 per cent royalty on any device under one or more patents controlled by the same interest at any time subsequent to the commencement of the infringement complained of.

Quarterly Rejuvenation in Chicago

The quarterly rejuvenation of the Jovian Order in Chicago, held at the Hotel Sherman on the evening of Dec. 15, was a dignified and impressive affair. Those in attendance comprised ninety-one Jovians and thirty-seven candidates. Thirteen applicants for membership were unable to attend. The class of neophytes included many men of considerable prominence in the electrical and allied industries in Chicago. Before the initiation there was a dinner at which Mr. H. E. Niesz, statesman for Chicago, presided. Speeches were made by Messrs. E. H. Waddington, alternate statesman for Illinois; Perry R. Boole, Stentor; Sam A. Hobson, past-Jupiter and great chief Stentor; F. W. Harvey, Jr., chairman of the membership committee in Chicago, and W. N. Matthews, of St. Louis, reigning Jupiter.

Mr. Matthews outlined the objects of Jovianism and gave a brief review of the history of the organization, speaking of Mr. Sam A. Hobson as the most enthusiastic Jovian in the order. The order has nearly 13,000 members, 750 of whom are in St. Louis and about 700 in Chicago. Mr. Matthews explained how the work of the new commercial division might be expected to give exercise to the dormant possibilities of the "sleeping giant"—the Jovian Order. In a number of ways the new commercial division can make itself useful. One is the possible establishment of co-operative display rooms by electrical industries, and Mr. Matthews cited the example of Columbus, Ohio, where this has been done. The initiation, which was carried out in a careful and impressive manner, with elaborate accessories, was followed by a vaudeville entertainment. The well-trained degree team was made up as follows: Jupiter, Mr. George C. Richards; Neptune, Mr. W. E. Finley; Pluto, Mr. L. M.

Willey; Vulcan, Mr. T. C. Hawkins; Hercules, Mr. O. L. Johnson; Mars, Mr. J. W. Foster; Apollo, Mr. A. E. Lubeck; Avrenim, Mr. Charles Dubsky; Mercury, Mr. W. E. Bischoff; imps, Messrs. F. L. Lewis, captain; Robert Hayes, A. R. Johnson and J. Donohue. Mr. Morgan P. Ellis was stage director.

Electrical Illumination at Springfield (Mass.) Dedication

At the dedication last week of the new group of municipal buildings at Springfield, Mass., a brilliant display of outline lighting was a prominent feature. Over 1400 25-watt lamps were installed temporarily on the tower and adjacent buildings of the group. On the tower twenty 500-watt lamps were also used to mark the corners and top of the Campanile. The work was handled by the M. W. Foster Electric Company, of Boston, Mass., energy being supplied for the display by the United Electric Light Company of Springfield.

Tendencies of Commission Regulation

In an address before the Los Angeles City Club in which he discussed the subject of regulation Dr. George L. Hoxie, New York, said in part:

"The commissions were organized in response to a demand that abuses be corrected. The abuses were intolerable, and they have been corrected to a very large degree. The work of the commissions has always been to render justice only in one direction—that is, in the direction of issuing orders to the corporations which they did not particularly welcome—reducing the rates, orders for operations and so forth, all in the direction of improving the service to the public and decreasing its cost.

"It may be readily seen that every such order issued brings us nearer to the time when to go further in that direction, instead of relieving the public justly, will put a burden on the corporation unjustly. Whether that time has been reached or not, necessarily it will be reached eventually. Then the question is, will public opinion stand back of the commissions in such a way that it will permit them to hold the scales of justice evenly between corporations and the public?"

In a letter issued by E. W. Clark & Company, of Philadelphia, it is said that state commissions are usually fair and reasonable and do not impose unnecessary hardships on the companies. It calls attention, however, to the fact that very few of the commissioners have any knowledge of the operation and management of public utilities at the time of their appointment. The letter adds:

"This, however, is a situation with which the utilities corporation must cope until such time as there shall come to the commissioners, through long service, knowledge of the business in which they are engaged. And during the 'period of learning' the training the commissioners will be getting must be, in a large measure, at the expense of the utilities. The majority of commissioners so far appointed have represented the highest type of citizenship in their respective states. These commissioners are well paid, as far as salaries are concerned, and for this reason there have been drafted into the service men who are of high personal qualifications. No local prejudices are permitted to interfere with the decisions of such men, and there is very little possibility of such tactics as are sometimes employed by councilmen and other city officials in 'holding up' corporations for graft for the 'killing' of obnoxious legislation.

"While the commissions have been in operation for only a few years, enough has been gleaned from their decisions to warrant the assertion that they will eventually work out to the benefit of both the corporations and the public. True, there have been some radical decisions which have not met favor with the companies affected, but there have also been others which have shown a tendency on the part of the commissioners to deal fairly with the corporations and to consider their interests in just as important a light as they do the welfare of the general public.

"It is to the interest of the utility corporations and the public that most of the commissions have supervision over the issuance of new securities. To the scrupulous operator this provision is not restrictive. Securities having the indorsement of a state commission are naturally much easier to sell and they represent an added protection to the investor."

Report of Secretary of Commerce

Secretary of Commerce Redfield in his annual report, made public on Dec. 15, outlines his ideas in regard to trust legislation. He says in part:

"That there are immediate and well-known conditions that should and can be remedied by law is apparent. Some of these remedies are, for instance, a law providing that there shall be a presumption that all restraints of trade are unreasonable and placing the burden of establishing the reasonableness of such restraint upon the party alleging it; legislation looking to fundamental charter provisions for every corporation doing interstate business; that stocks and bonds shall not be issued except for money or property at its true money value, preventing the watering of stocks; that corporations shall not hold stock in other competing companies, and that neither a person nor a corporation shall at the same time own a controlling interest in two or more competing corporations, and that the officers of corporations shall not be affiliated directly or indirectly by holding office in other corporations.

"Regardless of such legislation, however, there still remains a fundamental economic fact to be determined, to wit, whether the trust or monopolistic form is socially and economically efficient in production, as is alleged, and upon the solution of this problem must depend the ultimate attitude of the government toward combinations and consolidations in business.

"It is contended by some that with the increase in the size of industrial enterprises there goes a reduction in the cost of extraction, manufacture and distribution, and that such reduction in cost is accompanied by lower prices to the consumer and does not involve a reduction in wages or an impairment of the conditions of labor.

"According to this view there is a point beyond which increase in size does not result in increase in efficiency, but rather in loss and waste, so that the maximum efficiency is not attained by large combinations but by concerns of moderate size.

"It is important that we should know the truth about the fixing of retail prices and as to whether giving the privilege of so fixing the prices to a manufacturer tends toward monopoly or does not so tend. Nations abroad are said to favor by law that which we forbid. The law with us is for the time established by the decision of the Supreme Court that the fixing of retail prices on the part of manufacturers is unlawful. If, however, new legislation should in the future be required, it is important that the truth be known lest injustice be done not so much to the manufacturer as to the consumer.

"Some men, well informed, argue that the fixing of retail prices under conditions where competition in manufacture exists tends to promote competition. Others say that the refusal to permit the fixing of retail prices tends to monopoly because, in the cut-throat competition certain to follow, obviously the stronger competitor will survive and may

eventually have the business in his own hands, for the law forbids the making of agreements to maintain prices, and under these circumstances the weakest must go to the wall.

"An investigation of trade agreements is also in progress, with a view to establishing some facts as to what agreements, if any, apparently in restraint of trade are really in aid of competition and should be exempted from the operation of the Sherman act. There is also an investigation pending with reference to the merits and demerits of a condition which prohibits a uniform price from being fixed by manufacturers and jobbers, binding upon retailers as to articles of their manufacture."

The Secretary asks for an appropriation of $431,700 for an inquiry into the efficiency of large corporations.

Street-Lighting Tables for 1914

To insure the greatest possible accuracy, the *Electrical World's* street-lighting tables for 1914 have been prepared as three separate schedules correct respectively for the northern, middle and southern sections of the United States. This year (the twenty-fifth that these street-lighting schedules have been issued) an appropriate set of the tables will be distributed gratis to every central station and lighting plant in this country and Canada. On request the schedules will also be sent gratis to any subscriber desiring a copy.

The departure in issuing the tables for 1914 as three different schedules based on geographical latitude was adopted to attain greater accuracy than was hitherto possible with a single set of tables. As a result the figures now cover the entire area of the United States and southern Canada with a maximum error of less than ten minutes.

The northern tables are correct within five minutes for the States of Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, Michigan, Wisconsin, Minnesota, the Dakotas, Montana, Wyoming, Idaho, Oregon and Washington, and for southern Canada.

The middle schedules (which are virtually a continuation of the tables of former years based on the latitude of Philadelphia) apply with an error of less than ten minutes to all the North and Middle United States lying north of the southern boundaries of Virginia, Kentucky, Missouri, Kansas, Colorado, Utah and Nevada, including the entire area of the States mentioned as well as all of California north of Monterey. The southern schedules apply to the States of North Carolina, South Carolina, Georgia, Florida, Alabama, Tennessee, Mississippi, Louisiana, Arkansas, Oklahoma, Texas, New Mexico, Arizona and that section of California south of Monterey.

As in previous years, the schedules give the times for lighting and extinguishing lamps on the "all-night system," the "Philadelphia moonlight system" and the "Frund system."

The data in Table No. 1 have been compiled in such a manner that by following this schedule the lamps are lighted one-half hour after sunset and are extinguished one hour before sunrise, giving a yearly operation of about 3830 hours. An "all-night" lighting schedule, giving a yearly total of about 4000 hours, could be obtained by lighting fifteen minutes earlier and extinguishing fifteen minutes later than shown in this table.

In the so-called "Philadelphia moonlight schedule" (Table No. 2), beginning the fourth night after new moon, advantage is taken of the moonlight, and on nights when the moon is full or nearly so the lamps are not lighted. On other moonlight nights the lamps are extinguished one hour after moonrise and lighted one hour before moonset. With this schedule the lamps are in operation about 2000 hours per year.

Table 3 is calculated according to the system of Mr. Frund and ignores the moon until after midnight throughout the year. The lighting hours after midnight are the same as those in Table No. 2. This schedule entails the use of lamps for about 3000 hours per year.

All of the tables are based on mean local time. Where standard time is used and it varies considerably from local sun time the proper deduction or addition must be made. For the convenience of users, hours after midnight are set down in the tables as being a continuation of the night of the date indicated.

As above noted, a copy of these street-lighting tables may be obtained gratis by addressing the *Electrical World*, 239 West Thirty-ninth Street, New York City, and specifying the set of schedules desired.

Consolidation of Doherty Holding Companies

Plans have been perfected whereby three of the Henry L. Doherty & Company holding companies will be consolidated. The Cities Service Company will acquire the properties and assets of the Utilities Improvement Company and the Consolidated Cities Light, Power & Traction Company. The transaction will be carried out through an exchange of stock. Utilities Improvement Company preferred stock will be exchanged share for share for Cities Service Company preferred stock. For each two shares of Utilities Improvement Company common stock one share of Cities Service Company common will be given. For each two shares of Consolidated Cities company common stock one share of Cities Service Company common will be given. The 5 per cent bonds of the Consolidated Cities company will remain outstanding. With these changes the Cities Service Company will have outstanding $27,368,426 preferred stock and $15,718,380 common. It will have about seventy operating companies serving a total population of about 2,000,000 and with gross revenues of over $17,000,000.

In his letter to stockholders of the companies Mr. Henry L. Doherty, the president, says in part:

"This decision was reached after careful study and much discussion, especially with our English associates, and it is the judgment of your directors that the consummation of this arrangement, whereby the assets of the three companies are combined in one organization, will advance the interests of all stockholders of the three companies.

"The above action has put the Cities Service Company in a position to provide for the future requirements of its financing on a broad and sound basis. Arrangements to this end have been made with European bankers. A London office will be opened and several London directors will be admitted to the board.

"The Cities Service Company thus becomes one of the largest American public utility holding companies. The net earnings from operation of its subsidiary properties for the past year were more than two and five-eighths times the total interest charges on underlying bonds and other indebtedness.

"The larger volume of its assets will give it a stronger recognition than it has heretofore had. Its factor of safety, because of the diversified location of its properties in widely separated localities throughout the United States and Canada, the broader market for its securities because of the very much larger number of stockholders and consequent wider distribution of its securities, the greatly enlarged equity and earning power behind its fixed obligations—all of these tend to establish for the company an improved financial position.

"Beginning from Oct. 1, 1910, dividends of the Cities Service Company have been continuous, the first being a quarterly dividend paid Jan. 1, 1911, 1½ per cent on the preferred stock and three-quarters of 1 per cent on the

common stock. Since Jan. 1, 1911, its dividends have been paid monthly, on the first of each month, one-half of 1 per cent monthly on the preferred stock, and on the common stock in 1911 at the rate of 3 per cent per annum, in 1912 at the rate of 4 per cent per annum, and in 1913 at the rate of 5 per cent per annum. Beginning with the January dividend of 1914 (payable Feb. 1), the dividend rate on the common stock will be 6 per cent per annum.

"The properties which the Cities Service Company will now control and operate are in prime operating condition, large amounts having been expended on them this year for extensions, improvements and betterments, in addition to all other necessary expenditures for maintenance or upkeep, thereby providing for the increasing demand for service in the communities supplied. This consolidation will enable the company to effect many important economies in operation and is made on such a basis that there will not be a reduction from the present rate of earnings on the preferred and common stocks of the Cities Service Company. These earnings for the year ended Oct. 31, 1913, were more than twice the preferred dividend requirements, and were sufficient, after paying 6 per cent preferred dividends, to show more than 10 per cent earned on the average amount of common stock outstanding for the year.

"It is estimated that net earnings for 1914 will, after payment of interest on the company's 7 per cent notes and dividends on its preferred stock, be equivalent to fully 14 per cent on the total amount of common stock now to become outstanding. Your officers are enabled to make this prediction because of their confidence that the reports and estimates furnished by the various operating managers and engineers and tabulated and verified by our auditors are conservative and reasonable."

National Civic Federation Utility Bill

The public utility commission bill, drafted by the department on regulation of interstate and municipal utilities of the National Civic Federation and submitted at the annual meeting in New York on Dec. 11, was not adopted. The thanks of the federation were given to the department which considered the matter and the bill was then referred to the executive council with power to act.

At the session on Dec. 12 Mr. John Hays Hammond made an address on the Sherman law. He favors maintaining the basic principle of the Sherman law—at least until a new, substantive law shall be enacted to protect the interests of the public against possible aggression on the part of trusts. He does not believe there is any need of a new law to supersede the Sherman act, but, while this act may be regarded as the keystone of the law governing modern industrial development, it does need further definition and amplification by supplemental legislation. Further definition is required because of existing uncertainty as to the legality of corporate procedure; amplification is necessary to prevent objectionable practices which may not be inhibited by the present law—but more particularly for the purpose of increasing the elasticity of the law to permit corporate practices when of undoubted value to industry and yet not detrimental to the general public.

Mr. Hammond also favors a federal incorporation act. The regulation of corporations involves problems so comprehensive and complicated that he believes the administration of the laws governing their conduct should be left to an interstate industrial commission. This commission should consist chiefly of business men, with whom should be associated experts on economic subjects and lawyers who have had extensive corporation practice. The dignity of this commission should be on a parity with that of the Supreme Court of the United States—in which case it would appeal to the ambition of men of the highest ability who have the requisite qualifications.

With the Sherman law amended and yet left flexible enough to admit of the application of the light of reason in decisions of the commission, Mr. Hammond believes there would be an instrument which would meet all the requirements of the present industrial development.

Milwaukee Merchants' Co-operative Christmas Festoons

Wide-awake and enterprising merchants in the outlying districts of Milwaukee do not intend to sit idly by and allow all of the profitable Christmas trade to be drawn to the brighter down-town districts. To make their own streets attractive they have gone in together, each contributing as his means will permit, and have suspended incandescent-lamp festoons on the trolley span wires of the Milwaukee Electric Railway & Light Company. Energy for the lamps is taken from the direct-current feeders on the poles.

The construction has been made as inexpensive as possible. By clamping an iron upright to the top of the poles,

FESTOON OF INCANDESCENT LAMPS ON STREET IN MILWAUKEE

an iron wire, about No. 9 in size, is supported well above the trolley wires. The lamps, wired in multiple series, are strung along this support and curve downward at the ends near the poles to form an arch. In the Third Street district arches are placed across the street at each pair of trolley poles.

Effect of Utah Power & Light Decision

The decision of the United States Circuit Court of Appeals in the Utah Power & Light Company case was mentioned in a previous issue of the *Electrical World*.

The decision holds that the act of May 14, 1896, empowering the Secretary of the Interior to permit, under general regulations to be fixed by him, the use of, or rights-of-way upon, the public lands and national forest reservations for the purpose of generating, manufacturing and distributing electric energy repeals the act of July 26, 1866, in so far as it related to the subject of generating and distributing electric power and that the company must acquire its rights-of-way in accordance with the provisions of the later act.

The court denies the company's contention that it was protected in its tenure because that tenure was authorized by the laws of the State of Utah, exercising sovereign and exclusive jurisdiction with respect thereto. The court says:

"The proposition that absolute and perpetual rights in the public lands may be acquired for private gain by mere appropriation, without purchase or compensation, and in

the exercise of a state sovereignty which transcends the constitutional power of the Congress, is a somewhat startling one. The constitution of the United States provides that 'Congress shall have power to dispose of and make all needful rules and regulations respecting the territory or the property belonging to the United States.' This is the supreme law of the land and embodies an express grant of power to the national government."

The court holds further that in the express stipulation of the act enabling the people of Utah to form a constitution and state government they disclaimed all title to the unappropriated public lands within the boundaries of the State, and until the title to these lands has been disposed of by the United States it shall remain subject to the disposition of the federal government. This provision was later incorporated in the constitution of Utah, thereby becoming a part of the law of the State, and it secured to the United States full control of the public lands within the limits of the State. On this point the court says: "The exercise by Congress of a power which is granted in express terms must supersede all legislation over the same subject by the states."

The decision reverses the decree of the lower court and remands the case for further proceedings. The result of this would be the filing of an answer by the Utah Power & Light Company, the retrial of the case in the United States District Court and an appeal by the company through the United States Circuit Court of Appeals to the United States Supreme Court. However, a stipulation might be entered into for a hearing of the case on the present record in the United States Supreme Court. Just which course will be pursued has not yet been determined. It is, however, the intention of the company to have the case heard by the United States Supreme Court by one of these methods.

Mr. Vail on Government Ownership

A decline in American Telephone & Telegraph Company stock, following the reports from Washington about government ownership of telegraph and telephone lines, led Mr. Theodore N. Vail, president of the company, to issue a statement in connection with the announcement of a declaration of the regular quarterly dividend of 2 per cent. Mr. Vail said on Dec. 16:

"If it were not for this feeling of uncertainty on the part of a number of our stockholders I should not be at all concerned over the discussion of the possibility of government ownership of telephone lines. If the government takes over the telephone property there will have to be an appraisement, and any appraisement that can be made which will be upheld by the courts will give our property a greater value than that at which we carry it on our books.

"I am no more afraid of government competition, obviously, than I am of government ownership."

Mr. Vail commented as follows on the plan suggested by Congressman Lewis for purchase of the telephone lines and their use for telegraph purposes: "If they are able to use the telephone wires to take care of the telegraph business, they will be able to do something that we have not been able to do."

The annual report of Postmaster-General Burleson, suggesting government ownership of telegraph and telephone lines, was submitted to Congress on Dec. 17. It said in part:

"A study of the constitutional purposes of the postal establishment leads to the conviction that the Post Office Department should have control over all means of communication of intelligence. The first telegraph line in this country was maintained and operated as a part of the postal service, and it is to be regretted that Congress saw fit to relinquish this facility to private enterprise. The monopolistic nature of the telegraph business makes it of vital importance to the people that it be conducted by unselfish interests, and this can be accomplished only through government ownership.

"Every argument in favor of the government ownership of telegraph lines may be advanced with equal logic and force in favor of the government ownership of telephone lines.

"Since June last the department has been conducting an investigation to determine the desirability and practicability of extending the government ownership and control of means of communication, with a view to the acquisition by the government of the telegraph and telephone facilities, to be operated as an adjunct to the postal service. The Postmaster-General is now engaged in reviewing the data collected, and later, if desired, will submit same to the appropriate committees of Congress for their consideration."

New York Meeting of Electric Vehicle Association

At the meeting of the Electric Vehicle Association held in New York Dec. 16 abstracts were read of the papers delivered before the recent convention at Chicago. These papers were abstracted briefly in the Nov. 1 and Nov. 8 issues of the *Electrical World*.

The president's address was first reviewed by Mr. Harvey Robinson in the absence of its author, former President Arthur Williams. This was followed by an abstract of a paper entitled "Electrical Vehicle Salesmanship," by Messrs. George H. Kelly and E. J. Bartlett, which was read by Mr. William P. Kennedy. At its conclusion Chairman F. W. Smith remarked that the intention of the association is to follow out a number of the suggestions made therein, adding that a committee has been formed, with Mr. W. H. Blood, Jr., as chairman, to promote better co-operation between manufacturers and central stations.

Mr. H. F. Thompson called attention to a statement made in the paper on vehicle salesmanship that 1400 central stations had been solicited by the Baker Motor Vehicle Company for information regarding a plan of co-operation and that only twenty replies had been received. He declared this to indicate that the electrical industry as a whole is not interested in the electric vehicle. Mr. F. N. Carle suggested that an analysis be made of conditions in a number of cities in different sections of the country. In approaching a prospective user of electric vehicles care should be taken to give him statistics of a locality similar to his own.

Mr. D. F. Tobias, of the United Electric Light & Power Company, New York, recited how his company is endeavoring to co-operate with manufacturers and garage owners. At present, he stated, there is a lack of proper garage facilities in New York City, and he added that more vehicles could be sold if the garages were better fitted for electric-vehicle service. The electric company has opened part of its 147th Street garage to the public. New garages are being built and the company is exerting itself to the utmost to increase the accommodations throughout that part of the city in which it gives service. Mr. C. L. Littlefield, of the New York Edison Company, also told of the activity of his company in promoting co-operation.

Mr. Day Baker outlined briefly the reports of the local sections given at the Chicago convention. Mr. Bruce Ford commented on the paper entitled "Recent Developments in Lead Batteries" delivered by himself at the convention. Mr. F. N. Carle then read abstracts of his own paper, "The Merchant, the Central Station and the Electric Truck," and a paper by Mr. E. L. Callahan on "Co-operation of Manufacturers and Central Stations." Mr. E. W. Curtis followed with a few words on Dr. E. E. Pratt's address before the convention. Mr. D. F. Tobias closed with an abstract of a paper prepared jointly by himself and Mr. C. A. Duerr on "The Electric Vehicle in Department-Store Service."

The Dielectric Strength of Thin Insulating Materials

At the 289th meeting of the American Institute of Electrical Engineers, held at New York, Dec. 12, Mr. F. M. Farmer, of the Electrical Testing Laboratories, New York City, presented a paper on "The Dielectric Strength of Thin Insulating Materials," reporting the results of tests made to determine the effect of electrode area on the apparent dielectric strengths shown by various insulations in the form of thin sheets.

Using two similar flat, circular electrodes ranging from 0.0156 in. to 6 in., 10 in. and 15 in. in diameter, placed directly opposite each other, tests were made (1) on insulating cloth and thin-sheet hard rubber in air; (2) on insulating cloth in air and in transformer oil; (3) on transformer oil with various spacings, and (4) on air with various spacings. These experiments showed conclusively that the apparent dielectric strength of insulating materials in the form of thin sheets is materially higher with small electrodes than with disks of large diameter. Although the amount of variation differs widely with different materials the general rule thus discovered is believed to apply to all dielectrics, whether gaseous, liquid or solid. Curves were presented showing the numerical data obtained for the conditions of the experiments. With ordinary sheet insulating materials such as paper and cloth, variations of 50 per cent were found between the values obtained using the 0.0156-in. electrodes and those 8 in. or 10 in. in diameter. With oil, under the same conditions, the variation was even 1000 per cent. While, in accordance with the general opinion, it is true that with very sharp needle points failure will occur at a relatively low voltage, the results of the tests show that if the size of the electrodes be increased to any appreciable area, the corresponding puncture value is much higher than with large electrodes.

In conclusion, Mr. Farmer recommended the formulation of standard specifications for testing insulating materials, especially when in the form of thin sheets.

Discussion

Among those called on by President C. O. Mailloux during the discussion were Messrs. F. W. Peek, Jr., Schenectady, N. Y.; C. E. Skinner, Pittsburgh, Pa.; H. W. Fisher, Pittsburgh, Pa.; M. E. Tressler, Pittsfield, Mass.; Dr. E. B. Rosa, Washington, D. C.; Clayton H. Sharp, New York; John B. Taylor, Schenectady, N. Y.; A. E. Kennelly, Boston, Mass.; D. B. Rushmore, Schenectady, N. Y.; H. M. Hobart, Schenectady, N. Y.; W. I. Middleton, Cambridge, Mass., and C. F. Scott, New Haven, Conn.

Mr. Peek said that with films of oil 0.001 in. thick it has been possible to obtain spacings at the rate of 1,000,000 volts per cm. While the air loss does not begin to take place until after break-down has occurred, losses in the case of solid insulation start as soon as the voltage is applied, heating and weakening the insulation and finally causing it to rupture. Mr. Peek recommended that a standard size and shape of electrode for testing be specified.

Mr. Skinner, before presenting his own discussion, read brief communications from Messrs. Phillips, Thomas and R. P. Jackson. Mr. Thomas pointed out the possibility of errors due to distortion caused by electrostatic capacity in the test equipment. As such distortion and regulation will differ for each area and thickness tested, misleading results are apt to be obtained unless these effects are eliminated. Mr. Jackson observed that thin air pockets between the electrodes and the insulating material might become sources of corona, causing heating, unless the insulating material and electrodes were perfect plane surfaces held in contact by sufficient pressure.

Mr. Skinner recounted some early experiences in insulation testing, emphasizing the increasing importance of the subject of insulation. He admitted that the instantaneous-test value may be of little use in design work.

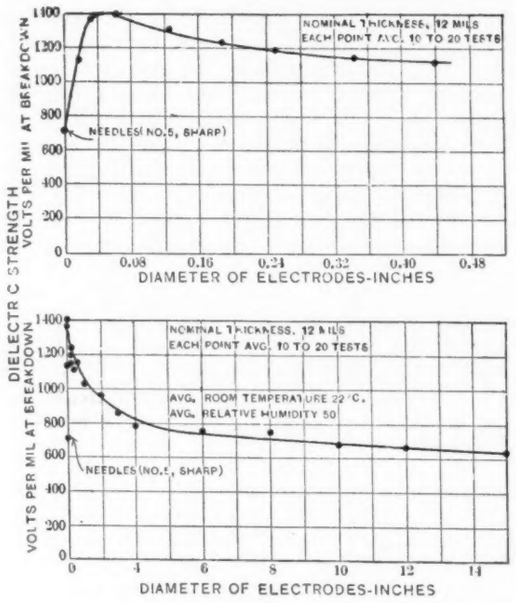
Mr. Fisher described an apparatus for testing varnished cloth. He also described the method of averaging the results of forty tests carried out in five groups.

Mr. Tressler confirmed Mr. Farmer's results in general, by experiments of his own, although he said be had not obtained such large variations in dielectric strength with electrodes of different diameters. Mr. Tressler recommended the use of one-hour tests where possible, the one-minute puncture voltage being used to indicate the starting voltage for the one-hour test. For solid insulations he recommended employing flat disk electrodes 19 cm in diameter, with square edges and insulated on the sides to prevent corona and arcing. For liquid insulations, he proposed using flat disk electrodes 25 mm in diameter.

Dr. Rosa commented on the effect of heating and the expenditure of energy losses in affecting the apparent dielectric strength of the insulating material.

Mr. Taylor recommended using direct-current for making voltage tests, in this manner eliminating the heating factor.

Dr. Kennelly said that the problem is often one of three dielectrics in series—the insulating material itself and the two thin strata of air held between the dielectric proper and the electrode plates. Tests using large electrode areas


DIELECTRIC STRENGTH VOLTS PER MIL AT BREAKDOWN
NOMINAL THICKNESS, 12 MILS
EACH POINT AVG. 10 TO 20 TESTS
NEEDLES (NO.5, SHARP)
DIAMETER OF ELECTRODES-INCHES
NOMINAL THICKNESS, 12 MILS
EACH POINT AVG. 10 TO 20 TESTS
AVG. ROOM TEMPERATURE 22 °C.
AVG. RELATIVE HUMIDITY 50
NEEDLES (NO.5, SHARP)
DIAMETER OF ELECTRODES-INCHES

EFFECT OF ELECTRODE AREA ON DIELECTRIC STRENGTH OF VARNISHED CAMBRIC WHEN TESTED IN AIR

will be expensive and tedious, and the speaker therefore recommended standardizing tests employing small electrodes and little samples.

Mr. Hobart commented on the need of establishing a relation between the aging of insulating material and the temperature to which it is subjected. With progress in electrical design, he said, it will be important to know how far builders may go with conservatism in the direction of higher temperature.

Mr. Middleton confirmed some of Mr. Farmer's results with figures obtained from his own earlier tests, and discussed the effect of corona in causing breakdown.

Mr. Scott spoke of the complexity of the phenomena often observed in insulating materials, emphasizing the need of correlating these data under general scientific laws. Insulation, he pointed out, still remains the single indefinite factor in the design and operation of electrical machinery, transmission lines and other electrical apparatus.

At the close of the discussion a smoker was held in the Institute rooms, where refreshments were served and social intercourse was enjoyed.

Developing the Latent Electrical Market

The co-operative movement and what it means to the manufacturer, central station, jobber and electrical contractor—Opinions of the leading men in the industry

THE history of commercial development offers nothing comparable to the almost magical growth of the electrical industry. In ten years the cost of construction and equipment has leaped from $500,000,000 to about $2,000,000,000 and the output of electrical energy has increased tenfold. Financiers have estimated that in order to meet pressing demands the industry will require new capital at the rate of $400,000,000 a year for the next five years. What the output of electrical energy will be at the end of that time or what the diversity of its use will be no one can approximate.

In spite of this predicted marvelous growth, there is a well-grounded impression that out of the total number of buildings in the United States only a small percentage are wired for electricity. Thus the possibilities for new business are very great, and when intensive cultivation of existing services is taken into consideration the outlook is exceedingly bright. Certainly the bankers have implicit faith in the stability of electrical investments and in the great future of the electrical industry, otherwise the money which is poured into electrical enterprises by the hundred millions would be diverted to some other fields.

On the assumption that only a small fraction of the possible electrical business of the country has been obtained, and as a means for the correlation and acceleration of all forces now working for electrical progress, the Society for Electrical Development was organized. Its primary object is the expansion of the electrical business. The movement, while it is one of the most encouraging that have taken place in the electrical industry for some time, is by no means unique. An organization similar to the Society for Electrical Development has been in existence in Germany since 1911, and the movement has met with greater success there than was anticipated. The Electric Vehicle Association of America last year raised $42,000 for general advertising purposes and this year $34,000. A fund of $300,000 is being raised by the National Commercial Gas Association to be devoted to a widespread campaign of publicity in the United States and Canada. Approximately $150,000 has already been raised for that fund. Outside of the utility field, the Gum Lumber Manufacturers' Association plans to continue work which has been done for several years by a number of individual manufacturers to further the interest of the gum lumber trade. It expects to spend $45,000 a year, the greater part of which will be devoted to advertising. Numerous other co-operative movements are working throughout the country to enlighten the public on the merits and uses of certain products.

The minimum sum which the Society for Electrical Development has set out to obtain before commencing its work is $200,000, and of this approximately $170,000 has now been subscribed. While the membership is growing the subscriptions based on that membership are not increasing in the same ratio. The central-station industry particularly is not responding to the movement as liberally as was anticipated, otherwise the society would now be in full swing. By concentrated work on that branch of the industry the society hopes to complete the necessary fund shortly. What the society proposes to do with that fund is best set forth by its general manager, Mr. J. M. Wakeman. When interviewed this week, Mr. Wakeman said:

AIMS OF THE SOCIETY

"According to statistics, only 20 per cent of the houses in the United States within serviceable reach of the central stations are wired for electric lighting, and not 1 per cent are wired for full electric service. Less than 20 per cent of the energy used in factories, foundries, shops, mills, etc., is electrical. This means that 80 per cent of the houses situated within serviceable distance of central stations constitute an enormous latent market, and that the factories, foundries, mills and shops using belt-driven machinery constitute another enormous latent market, and even the houses which are wired for electric lighting are only consuming a part of the energy which they could and would consume if they were wired for full electric service.

"The Society for Electrical Development plans to demonstrate to the owners of houses not already wired the advisability and practicability of adopting electric service and educating the people who are already using electric lighting to the advantages of the various electrical devices which can be introduced into the household as labor-saving devices, or to add to the comfort or convenience of the home. This will develop the latent market, as will also the campaign which we purpose to carry on in the trade papers of the country, advocating the use of electric motors in industrial plants and pointing out the many possible applications and advantages of electricity.

"All this additional business means to the manufacturer of motors and other devices larger opportunities for business, which means more trade for the supply jobber and dealer. It means more work for the contractor, and it means more revenue for the central station.

"The central station is in a position to benefit by every sale made by the work of this society. Every time the society succeeds in inducing a householder or a manufacturer to put in an energy-consuming device which otherwise would not have been sold it brings added revenue to the central station. In fact, the central station is the residuary legatee of the work of this society and should be its chief support. Some central stations feel that their field is entirely local and they cannot see any advantage in subscribing to a national effort. As a matter of fact, the educational campaign which this society purposes to carry on is of a character that no central station can afford to undertake alone. It is not intended to take the place of the local advertising and local effort for business, but is intended to enhance the value of the latter.

"National magazines coming into the central station's territory, bearing the message "Do it electrically" put in plain English and presented to the people in an attractive manner, thus setting them thinking about the advantages of the use of electricity, will go a long way toward making it easy for the local central station by its advertising and its direct business-getting campaign to secure results.

"Some jobbers also feel that their business is local and hardly realize that our campaign is going to create a demand for supplies which the dealers will have to fill, which means a greater business for the jobbing houses,

which in their turn supply the dealers. The fact that 60 per cent of the important jobbers of the United States are already members of the society demonstrates the fact that the majority of the jobbers realize the value and importance of the work of the society.

"Our campaign among architects, showing them the necessity for providing full electric service instead of merely electric lighting, and our campaign educating the people to the ease with which old houses can be wired for electric service, will mean more work for the contractors. It is self-evident that the creation of a greater demand for motors and other electric devices must mean more business not only for the manufacturers of such apparatus but also for the manufacturers of wire, fuses, motors, transformers, insulators and every other device used in the production and transmission of electric current.

"The amount of the subscription of any one individual company is comparatively small, but its accumulation into one fund to be expended under the direction of the officers of this society will enable the electrical industry to develop the latent market very quickly and more economically than could be done by any other possible method.

"There are, of course, in the electrical industry a number of individuals who feel that the other man may do the work of developing the industry, and that they themselves will reap the benefit of the other man's work. While, of course, this will be true to a certain extent of the work done by the Society for Electrical Development, there are a number of ways in which the members will receive direct benefits that will not accrue to those who are not subscribing to the movement.

"It has already been demonstrated that the educational advertising carrying the name of the society only will result in a tremendous number of inquiries from all over the country as to where certain devices can be purchased, what such devices would cost, the cost of installation, etc. All such inquiries will be addressed to the society and will be forwarded to the local members who are in a position to answer them. This means that in a city where a number of jobbers are members and other jobbers are not supporting the movement the members will get all the inquiries brought in by the advertising circulated in that city. Thus, if a man is not broad-minded enough to be imbued with a spirit of co-operation and looks at this matter from a purely selfish standpoint, he can, even from this point of view, count upon getting returns far greater than his subscription.

"To recapitulate, the work of the society is not intended to take the place of individual effort in the local market, but its work will be broad enough to bring direct results to its members and to give each interest represented in the society a great and lasting benefit. The development of the latent market is the great commercial problem of the electrical industry, and the solution of this problem is the work of the Society for Electrical Development."

How the Industry Regards the Movement

In order to ascertain how the industry as a whole regarded the movement, the *Electrical World* interviewed representatives of the four electrical branches embraced in the Society for Electrical Development. What these men think of the movement is set forth in their own words as follows:

Mr. Henry M. Byllesby, president H. M. Byllesby & Company, Chicago: "You can quote me as favoring the aims of the Society for Electrical Development. Co-operation for such a worthy object as the increase of the use of electrical energy and electrical appliances is certainly most commendable, not only from the viewpoint of all interested in the industry, but from the broader view that the work should further public convenience and industrial efficiency. I am particularly pleased with the declared purpose of the society to develop means and methods tending to promote the welfare of individuals identified with all branches of the industry, and I am in hearty accord also with the effort to encourage harmonious relations which shall assist in maintaining the industry high in the confidence of the public."

Mr. Neil C. Hurley, vice-president Hurley Machine Company, Chicago: "We have no hesitation in saying that we are in entire and cordial sympathy with the Society for Electrical Development and its aims and methods. We want to help and be helped in our relations with the electrical industry, and we are confident that the society affords a means to that end. We try to do all in our power to further the industry, and our experience with the society is such that we are confident that its purpose likewise is to advance the interests of the industry as a whole in a broad-minded and fair-minded way."

Mr. W. W. Low, president Electric Appliance Company, Chicago: "In my judgment, the Society for Electrical Development deserves hearty encouragement. One reason for this belief is that general business conditions are somewhat depressed at the present time, owing, perhaps, to the tariff readjustment and the currency agitation. Now, if we can get this big movement for electrical co-operation under way, say by the first of the year, the effect ought to be to create new business or give an impetus to business in new channels. Thus, it seems to me, there is a great opportunity, by doing the work for which this society is organized, to stimulate the electrical industry during the months ahead of us when it, with other industries, may be otherwise retrogressive. In short, the aims of the society are not only correct at any time but particularly apropos at present to tide over what promises to be a rather lean period."

Mr. W. E. Robertson, Robertson-Cataract Electric Company, Buffalo, N. Y.: "The Society for Electrical Development offers the jobber an opportunity to participate in and help shape a campaign the purpose of which is to create an increased demand for electrical apparatus, supplies and devices of all kinds. The jobber's stock is so diversified that no matter where the public's interest is quickened the effect is immediately felt in some department of his business. Increased demand means an opportunity for net profit, because operating expenses spread over a small or moderate demand in a given line of material consume the entire possible gross profit. A net profit is only possible where there is a brisk or healthy demand. By co-operating with the other branches of the industry the jobber makes possible the existence of the Society for Electrical Development. Its existence will practically insure a satisfactory volume of business. In good times the activity of the society will augment the peak of his business, and this augmented peak furnishes the opportunity for an exceptionally high net proft. In dull times the activities of the society will increase his volume to a point where the possible profit on it will meet, or very nearly meet, his operating expense. Knowledge of the tremendous diversity in the stock carried by the jobber, in addition to the low cost of membership in the Society for Electrical Development, is all that is necessary to convince a logical business man of experience that the Society for Electrical Development offers an opportunity to participate in an enterprise in which he, the jobber, cannot lose."

Mr. Ernest Freeman, Freeman-Sweet Company, Chicago, president National Electrical Contractors' Association: "I am 'plugging' for the Society for Electrical Development all the time. I believe earnestly that this organization will promote the interests of the electrical contractor, electrical manufacturer, electrical dealer and the central-station operator. Naturally, I am particularly interested in the fortunes of the electrical contractor, and

I am urging members of the National Electrical Contractors' Association to join the Society for Electrical Development and help it all they can. Co-operation is a good thing for all concerned. It is the order of the day, and you can put me down as favoring unreservedly the aims of the Society for Electrical Development."

Indorsements of the movement have also been received from Messrs. J. B. McCall, president of the Philadelphia Electric Company; E. W. Rice, Jr., president of the General Electric Company; E. M. Herr, president of the Westinghouse Electric & Manufacturing Company; T. N. Vail, president of the American Telephone & Telegraph Company; H. B. Thayer, president of the Western Electric Company; F. A. Vanderlip, president of the National City Bank of New York; Thomas A. Edison, C. P. Steinmetz and Elihu Thomson. Their estimates of the movement and its possibilities are as follows:

MR. J. B. MCCALL, president of the Philadelphia Electric Company: "The object, underlying principles and plans of the Society for Electrical Development appeal strongly to me as representing essential progress and refinement in more efficiently extending electrical service. The fact that selling costs of different branches of our industry, particularly the competitive branches, are either stationary or tend to increase from year to year is a matter that warants serious consideration for improved efficiency in distribution. This situation contrasts strongly with the tremendous strides made in research, engineering and manufacturing. I believe that this trade movement will not only greatly facilitate the extension of our business but will, in doing this, develop a spirit of harmony and co-operation within the trade and toward the public of the greatest possible value. Our membership in the society is our strongest indorsement."

MR. E. W. RICE, JR., president of the General Electric Company: "I am in hearty sympathy with every practical effort to extend the electrical business, and it would seem obvious that valuable work may be done along the lines proposed for the new society. The electrical industry as the latest comer in the industrial field should lead in new business methods. All electrical workers, including competitors, have manifold interests in common; all are vitally interested in finding new fields to cultivate, in the reduction of waste, the promotion of honest business methods and the formation of correct public opinion. While many have come to the conclusion that under modern conditions there is a necessary limit to the old competition, all will probably agree that there is no limit to the new competition, the competition in co-operation."

MR. E. M. HERR, president of the Westinghouse Electric & Manufacturing Company: "The aims and purposes of the Society for Electrical Development have greatly interested me from their inception, and I have watched the progress in this work with a great deal of interest. The purposes and aims of the society cannot help but be of great advantage and value in the development of the electrical business. I have recently returned from a short trip in the East and have been very much interested and pleased to see the slogan 'Do it electrically' prominently displayed in many places."

MR. THEODORE N. VAIL, president of the American Telephone & Telegraph Company: "Co-operation is the most effective factor of prosperity. Rational competition with co-operation is constructive and progressive and is the only cure for our present evils and the only hope of the future. If the Society for Electrical Development can help in bringing this about in electrical development it will have accomplished much, for in that field lies a great future."

MR. H. B. THAYER, president of the Western Electric Company: "Co-operation between the various elements of the electrical industry, such as the Society for Electrical Development proposes, is a broad and comprehensive undertaking, and if it is in any measure successful, should be of much value to the central stations, manufacturers, distributers and contractors in the electrical business."

MR. F. A. VANDERLIP, president of the National City Bank: "I believe thoroughly in the purposes of the Society for Electrical Development. It is founded on right principles and it is constructive in every way. It is based upon the theory of broadening the scope of its members' activities and not of being in any way detrimental to one for the benefit of another. At the same time, its own success is so involved with good service to the public that mutual advantage must be derived from its activities. From the extension and the enlargement of central stations and the broader dissemination of electrical service, much economy directly beneficial to the public can be effected. In the education of the public along the line of increasing electrical facilities, diverse load-factors can be obtained and service thus greatly cheapened. I believe the society, while based upon the natural desire for more business for its members, is at the same time doing real public service, and it should receive hearty support."

MR. THOMAS A. EDISON, Orange, N. J.: "I have been greatly interested in perusing the pamphlet dealing with the principles, plans and methods of membership of your society, and am much impressed with the wisdom displayed in its conception. It is indeed remarkable that, in a business of such phenomenal growth and having such keenly competitive interests, there could be evolved a plan sufficiently comprehensive to bring about at once an incalcuable increase of business to the good of all concerned while not in the least disturbing the benefits of proper competition. If the objects of the society are carried out as proposed, I think the next few years will show an enormous advance in the use of electrical devices."

DR. CHARLES P. STEINMETZ, Schenectady, N. Y.: "Co-operation is now the basis of prosperity. Competition, which has started our industrial progress, has become destructive and harmful to progress, if not limited and restrained by co-operation as the great economic force of modern industrial progress."

DR. ELIHU THOMSON, West Lynn, Mass.: "I believe that the Society for Electrical Development has a great field before it in harmonizing interests and preventing ruinous competition by the methods which imply co-operation and mutual understanding. To do this effectively will, of course, require wise administration and a sympathetic attitude on the part of those connected with our industry. I have no doubt that if these are secured the benefits which may accrue will go far to counteract many of the difficulties under which business is at present conducted, and tend to its future development in the most healthful and hopeful way."

Regarding the trade impressions of the Society for Electrical Development, Mr. H. H. Cudmore, who has visited various parts of the country as a lecturer for the society, said: "For several weeks it has been my privilege and pleasure to assist the officers of the Society for Electrical Development in performing field work, exploiting the many advantages to all engaged in the electrical industry in all its branches that will come from joining the Society for Electrical Development. The general impression of all the trade seems to be covered in one statement: They do not clearly understand the plans of the society. In proof of this I found in the cities of Pittsburgh, Pa., Columbus and Cincinnati, Ohio, and in Louisville, Ky., that all of the representative concerns engaged in the electrical business were glad to make application for membership in the society when they clearly understood what the definite plans and purposes of the society actually are. No indi-

vidual, firm or corporation that derives all or any part of its income from the electrical business can afford to remain unfamilar with the plans that are actually worked out, ready to be put in motion as soon as the minimum fund of $200,000 has been subscribed. More than three-quarters has been pledged, and membership in the society to-day is more valuable than any other plan individual members can possibly have to develop their own business, so my plea is that everyone engaged in the electrical business should at least post himself on the plans of the society immediately. If all will do this, they will join at once."

Public Service Commission News

Maryland Commission

The Maryland Public Service Commission has received a letter from Mayor Higgins of Easton, Md., asking that the complaint of the town burgesses against the Easton Light & Fuel Company be dismissed. The request was granted in an order issued by the commission. On account of differences between the public and the company the Mayor and Council had negotiated with a promoter for the establishment of a competing plant. However, the promoter announced that he could not secure the capital he had expected and a settlement has been made with the old company.

Ohio Commission

A joint petition has been filed with the Ohio Public Service Commission by the Dayton Power & Light Company and the Xenia Gas & Electric Company of Xenia asking that they be allowed to consolidate through the purchase of the entire stock of the Xenia company by the Dayton company. The Dayton company now owns all of the $100,000 bonds of the Xenia company and $95,000 of the $100,000 stock.

The Mahoning County Light Company has asked permission to sell $10,000 bonds which have already been authorized. The proceeds are to be used as a beginning in the equipment of an electric plant.

The Northern Ohio Traction & Light Company, of Akron, has reported to the commission that it is unable to sell at par $300,000 preferred stock, which was authorized some time ago. It requests that it be permitted to sell at 95.

Massachusetts Commission

A bill to reduce the membership of the Public Service Commission from five to three and to cut down the salaries of the commissioners from $8,000 to $5,000 will be introduced in the next Legislature. Under the former law salaries of the commissioners were paid by the railroads, and the new law not only increased the membership of the board but also raised salaries, so that the cost of regulation by this commission is likely to exceed $190,000 in the present year, as compared with $70,000 the year before. The supervision of telephone and telegraph companies has been added to the duties of the board this year. During the coming year the membership of the board will be materially changed, even if no additional legislation goes through. A plan is being discussed to appoint Commissioner Bishop, who retires in the summer of 1914, head of the inspection department. During the first half year of its existence the commission has been handicapped by considerable friction which it has not been able to conceal from observation at its public hearings, and the reorganization of its office force has been subjected to some criticism, although steps are being taken to improve the business activities of the board.

The Municipal Lighting Board of Rowley has petitioned the Gas and Electric Light Commission for authority to sell electricity for motor service at less than cost, setting prices varying from 15 cents net per kw-hr., for consumption up to and including 50 kw-hr. per month, to 8 cents for 800 kw-hr. and over.

New Jersey Commission

The Board of Public Utility Commissioners of New Jersey has disapproved of a sale involving $620,000 of 5 per cent consolidated mortgage bonds of the North Hudson County Railway by the Public Service Railway. The board renders its decision upon the ground that the sale of such entire issue to the Fidelity Trust Company of Newark at 97 without seeking competitive bids evidences favoritism and constitutes a departure from a sound and safe rule of action whereby the company would obtain less than the utmost possible amount from the sale of the securities. The board further states that while it has no interest in what purchaser may secure the bonds, it becomes its duty to see that the price brought by an issue involves no infringement of the rights of the shareholders of the company or its patrons. Inasmuch as any amount received for the refunding bonds less than par must be amortized during the life of the bonds, an additional burden by just this amount is imposed upon the patrons of the company and an additional barrier by just this amount is interposed between the company's shareholders and their dividends.

Nevada Commission

A supplemental opinion has been issued by the Public Service Commission of Nevada in the case involving rates of the Ely (Nev.) Light & Power Company. The commission issued an order some time ago prescribing rates for the company. The city of Ely was complainant in the case. The maximum rate ordered was 15 cents per kw-hr. The company did not obey the order and started proceedings in court to enjoin its enforcement. The commission filed an answer to the bill. Subsequent to these proceedings, a further hearing was held at which the company furnished additional data bearing upon the reasonableness of the rates prescribed by the commission. With further investigations and close analysis of the data and full consideration, the commission was forced to the conclusion that the order originally made would, if put into effect, reduce the earnings of the company to such an extent as not to leave a fair compensation for the service rendered or a reasonable return upon the value of the property used in performing the service. It therefore issued a supplemental order providing for a maximum rate of 17 cents per kw-hr. for the first 50 kw-hr. consumed per month: 16½ cents per kw-hr. for the next 100 kw-hr.; 15 cents per kw-hr. for the next 100 kw-hr., and 12½ cents per kw-hr. for all in excess of 250 kw-hr. per month. The minimum charge of $2 per month was reduced to $1.50. Motor and street-lighting rates were not affected by the order.

Mr. J. S. Shaughnessy, first associate commissioner, filed a dissenting opinion. He declared that the commission reached its conclusion on the basis of the reproduction value new of the property when the depreciated value should have been taken, that the operating expenses were seemingly excessive and that the order did not recognize the principles that a reduction in rates may result in a substantial increase in the volume of business. Mr. Shaughnessy added that in the valuation by the engineer for the commission the totals allowed for the different items were generous, the land used in operation being valued by comparison with the selling value of contiguous property. The plant and distribution system were put in at the going unit cost prices thereof. Buildings were valued on the basis of prices furnished for their duplication by two contractors at Ely. In addition, 20 per cent was allowed for engineering, superintendence, contingencies and interest during construction. The company submitted evidence to show that its aggregate investment for plant and improvements was $80,000, but the plant has been in operation six years, and during that time land values have depreciated. The investment was made at a boom time, when the population was 50 to 100 per cent greater than now. Mr. Shaughnessy favored a schedule of 12, 10 and 8 cents per kw-hr.

Current News Notes

SWISS BANKERS INSPECTING PUBLIC-UTILITY PROPERTIES.—Messrs. E. Odier and F. Dominice, of Geneva, connected with prominent financial interests of Switzerland and France, have recently completed a survey of some of the public-utility properties of H. M. Byllesby & Company, of Chicago, in which the interests they represent have considerable investments. At a recent luncheon given by Mr. Byllesby in their honor at the Union League Club, Chicago, they expressed themselves as pleased with the results of their inquiry.

* * *

NEW YORK'S URBAN TRAFFIC GROWING 90,000,000 A YEAR. During the year which closed June 30, 1913, the number of passengers carried by New York's electrically operated transit system—subway, surface and elevated—was 1,769,889,284. This total exceeds by 90,000,000 that for the previous twelve-month period—an increase equivalent to the entire population of the United States. The increase in the subway traffic alone was 25,000,000 for the year, and was practically equaled by the growth in the number of surface-line passengers. The nickels collected during the year by all the New York transit companies totaled $87,718,359.

* * *

POSTAL TELEGRAPH-CABLE COMPANY AGAIN SUFFERS LOSS FROM WIRE CUTTERS.—The Postal Telegraph-Cable Company offered a reward of $1,000 on Nov. 14 for information leading to the arrest and conviction of persons who have cut a number of its cables. The company has suffered in this way before, and there seems to be no doubt that the work is done maliciously. On the night of Nov. 12 a large cable on the top of a building at 179 North Wabash Avenue, Chicago, was cut. It is also stated that a cable on the South Side Elevated Railroad structure in Chicago was cut on the night of Nov. 13 in three places, and that single wires on South Halsted Street were also cut.

* * *

EXAMINATION FOR ACCOUNTANT, PUBLIC SERVICE COMMISSION.—An examination will shortly take place for the position of junior accountant for the Public Service Commission of the Second District, Albany, N. Y. It is open to men between the ages of twenty and thirty who have a knowledge of the theory and principles of economics, including accounting, finance and statistics. The examination will include a discussion of one of several topics, such as valuation, depreciation, capitalization and return on investment, especially related to public service problems. The position carries a salary of from $1,080 to $1,500 per annum. Application blanks may be secured from the State Civil Service Commission, Albany, N. Y.

* * *

TO RECLAIM 8,000,000 ACRES IN CALIFORNIA.—At a recent meeting of the California Realty Federation held at Del Monte, Cal., Mr. A. L. Shinn, of San Francisco, presented his plans for irrigating 8,000,000 acres in the Sacramento and San Joaquin Valleys, involving the development and transmission of large quantities of hydroelectric energy. Mr. Shinn proposes to conserve the water which now goes to waste through the floods of the Sacramento River, constructing reservoirs in the mountains at elevations of 2000 ft. to 3000 ft. The head available would be used for developing electrical energy, which would in turn be applied to pumping water up to lesser elevations—1000 ft. or less—for irrigation distribution at the head of the valley.

* * *

WATER-SUPPLY AMENDMENT TO CONSTITUTION IN NEW YORK.—A constitutional amendment adopted at the election in New York State on Nov. 4 provides that the forest reservation as now fixed by law shall be kept forever as wild forest lands. The Legislature may provide by general laws for the use of such lands for the construction and maintenance of reservoirs for municipal water supply, for the canals of the State and to regulate the flow of streams. Such reservoirs shall be constructed, owned and controlled by the State, but such work shall not be undertaken until after the boundaries and high-flow lines shall have been accurately surveyed and fixed. The Legislature shall provide for a charge upon the property and municipalities benefited for a reasonable return to the State upon the value of rights and property used and services rendered, which shall be fixed for terms of not exceeding ten years and be readjustable at the end of any term.

* * *

STATE TO CONSTRUCT ITS OWN LIGHT AND POWER CONDUITS.—Basing their action on the claim that it is their intention to escape possible monopolistic control in the distribution of electric light and power within the limits of the city of San Francisco, members of the California State Board of Harbor Commissioners made an announcement on Nov. 14 of plans for the State to lay its own conduits along the piers and bulkheads within their control. By thus owning its own electrical distribution system the State can buy energy from the lowest bidder. This action followed within a few weeks the published announcement of the intention of the Universal Light & Power Company to begin service on the zone system throughout the city of San Francisco. The latter company, according to a statement of one of its officers, will begin laying main-line conduits throughout the business section soon and claims that it will sell electricity at rates much lower than any now available.

* * *

GOVERNMENT OWNERSHIP OF RAILROADS.—Mr. W. C. Brown, president of the New York Central Lines, made an address before the directors of the Chamber of Commerce of the United States at Rochester, N. Y., on Dec. 8, in which he said that government ownership of railroads would be a dangerous mistake. He believes that the decision of the rate case now under consideration before the Interstate Commerce Commission will either substantially check the movement for government ownership or prove to be a long step in this dangerous direction. In his opinion, if the moderate advance asked by the railways is denied, it will be impossible for them to secure funds with which to make improvements. Without these improvements expansion of the commerce of the nation must gradually come to a halt. In this event, if it should come, the demand that the government provide the funds necessary to supply adequate transportation facilities will be irresistible, and government ownership and operation, with whatever it involves for weal or woe to the nation, will be the inevitable result.

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SOCIETY MEETINGS

NEW YORK COMPANIES' SECTION, N. E. L. A.—"Personal Initiative Within Corporate Enterprise," by Mr. J. W. Eaton, and "Instrument Maintenance," by Mr. S. E. Boyland, were the titles of two papers presented by their authors at a meeting of the New York Companies Section of the National Electric Light Association on Dec. 15.

* * *

SAFETY COMMITTEE OF THE EMPIRE STATE ASSOCIATION.—The executive committee of the Empire State Gas and Electric Association has appointed as members of the new safety committee for work in behalf of the association throughout the State Messrs. W. P. Strickland, New York & Queens Electric Light & Power Company; Henry Flood, Central Hudson Gas & Electric Company; W. L. Bruce, Westchester Lighting Company; A. T. O'Neill, Syracuse Lighting Company, and Victor T. Noonan, Rochester Railway & Light Company.

Boston Section, I. E. S.—Mr. L. A. Hawkins, of the research laboratory of the General Electric Company, Schenectady, N. Y., addressed the Boston Section of the Illuminating Engineering Society, Dec. 9, on the topic "The Nitrogen-Filled Lamp and Its Possibilities." The meeting was held in the Boston Edison company's auditorium, and the attendance numbered over 150.

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Meeting of Illinois Northern Utilities Branch, N. E. L. A.—At the regular meeting of the Illinois Northern Utilities Branch of the National Electric Light Association held at Dixon, Ill., Nov. 21, Mr. H. W. Young, of Chicago, spoke on "Selling Power from High-Tension Lines." The lecture was illustrated by some forty lantern slides showing many outdoor high-tension installations.

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Southern California Jovians' Dinner.—The Jovian Electrical League of Southern California met at Christopher's, Los Angeles, on Wednesday, Dec. 10, at noon, for lunch, with Mr. R. H. Manahan as chairman. Mr. F. T. Woodman, president of the Los Angeles Harbor Commission, spoke on "The Harbor and the Kilowatt," and the guests were also entertained by a few vaudeville numbers.

* * *

Architecture and Illumination.—At a meeting of the New York Section of the Illuminating Engineering Society, Dec. 11, Mr. Frank E. Wallis gave an interesting illustrated talk on classic styles of architecture and the design of architectural features with respect to the illumination they receive. Mr. Wallis' address was followed by a paper by Mr. Howard E. Watkins entitled "Periods of Architecture as Applied to Fixture Design."

* * *

Public Service Section, N. E. L. A.—A meeting of the Public Service Section, N. E. L. A., was held in Newark, N. J., on Dec. 15, with approximately 325 members and guests in attendance. Mr. Dudley Farrand outlined in an interesting way some of his experiences as president of the N. E. L. A. in its earlier days and called attention to the benefits resulting from the establishment of the various company sections, the idea of which originated during his administration. A paper on "New Business from Old Customers," describing the advantages and importance of obtaining this class of business in residence, commercial and industrial applications, was read by Mr. W. A. Cox. A paper on "The Extension of the Generation and Transmission System in Southern Jersey" was read by Mr. E. B. Meyer. The author described the generating station in course of construction at Burlington, N. J., the substations at Riverside, Bordentown and East Trenton, and the 51 miles of transmission line construction. The new-business possibilities of this district and the reason for various engineering details of the problem were outlined by the author and those who discussed his paper.

* * *

Railroad Men Studying Electrical Working.—At a meeting of the American Railway Association held in Chicago Nov. 19 the committee on electrical working presented a very brief report. It is giving attention to the questions of overhead working-conductor clearances and clearances for automatic train stops. Both of these subjects are also under discussion by the railway technical associations. The committee simply reported progress, desiring to await the conclusions of the technical associations before recommending action to the American Railway Association. Mr. George Gibbs, chief engineer of electric traction for the Long Island Railroad, is the chairman of the committee, the other members being Messrs. J. D. Isaacs, consulting engineer Southern Pacific Company; L. C. Fritch, chief engineer Chicago Great Western Railroad; J. H. Davis, electrical engineer Baltimore & Ohio Railroad; E. B. Katté, chief engineer electric traction New York Central & Hudson River Railroad; A. S. Baldwin, chief engineer Illinois Central Railroad, and A. R. Whaley, vice-president New York, New Haven & Hartford Railroad. The American Railway Association's membership represents 269,317 miles of track.

* * *

American Economic Association.—The twenty-sixth annual meeting of the American Economic Association will be held in Minneapolis, Minn., from Dec. 27 to 30. The American Sociological Society will hold its annual meeting at the same time and place. The tentative program of the American Economic Association meeting shows that among the papers to be presented are the following: "The Control of Public Service Corporations," by Prof. John H. Gray, University of Minnesota; "The Renewed Extension of Government Control of Economic Life," by Mr. David Kinley, president of the American Economic Association; "Theory of the Making of Railway Rates," by Dr. D. H. Meyer, Interstate Commerce Commission; "Syndicalism," by Mr. John Graham Brooks, Cambridge, Mass.; "The Economic Effects of the Supreme Court Trust Dissolutions," by Prof. Willard E. Hotchkiss, Northwestern University.

* * *

American Association for Labor Legislation.—The American Association for Labor Legislation will hold its seventh annual meeting in Washington, D. C., on Dec. 30 and 31. The meeting will be a joint session with the American Political Science Association. Among the papers to be presented are the following: "The Federal Industrial Relations Commission," by Mr. Frank P. Walsh, chairman Federal Industrial Relations Commission; "Labor Law Enforcement Through Administrative Orders," by Mr. Charles H. Crownhart, chairman Wisconsin Industrial Commission; "The Philosophy of Labor Legislation," by Mr. W. F. Willoughby, Princeton University, president of the American Association for Labor Legislation; "The Practicability of Compulsory Sickness Insurance in America," by Mr. Joseph P. Chamberlain, Legislative Drafting Association, New York. The afternoon session on Dec. 31 will be devoted to discussion of the subject of "Working Hours in Continuous Industries." Several papers will be presented on subjects of interest in this connection. Among those specially invited to lead the informal discussion on this subject, under the five-minute rule, are Mr. Robert S. Hale, Edison Electric Illuminating Company of Boston.

* * *

Detroit-Ann Arbor Section, A. I. E. E.—The second regular meeting of the Detroit-Ann Arbor Section of the A. I. E. E., which was held at the University of Michigan, Ann Arbor, Mich., was attended by many men prominent in Michigan engineering circles. Dean Mortimer E. Cooley of the university engineering department spoke on "Factors Determining a Reasonable Charge for Public Utility Service," and Prof. George W. Patterson talked on "Financial Versus Engineering Estimate of the Value of a Public Utility." Tables showing the distribution of capital invested in gas and hydroelectric plants were presented and discussed by Prof. H. C. Anderson. Mr. Lawton T. Hemans, chairman of the Michigan State Board of Railroad Commissioners, spoke at length on the work which the board has accomplished as well as that which it has before it. "Depreciation" was the topic discussed by Mr. Gardner S. Williams, consulting engineer, Ann Arbor. Prof. David Friday discussed the subject of bond discounts and suggested how such discounts should be entered on the books. About 150 were present. As the papers and discussions presented at this meeting were considered of general interest, effort is being made to have them printed. Mr. Ray K. Holland, electrical engineer, Ann Arbor, is secretary of the local A. I. E. E. section.

Hydroelectric Development at Tallulah Falls, Ga.—I

Station of Georgia Railway & Power Company the largest in operation in the South—Plant has high-head reaction wheels and very large outdoor substations

THE Georgia Railway & Power Company, of Atlanta, Ga., has recently placed in operation its hydroelectric station at Tallulah Falls, which is one of the largest water-power plants in the world. The station, which was designed and erected under the supervision of Mr. C. O. Lenz, consulting engineer of New York, has the distinction of being the largest now operating in the South and possesses the highest-head reaction turbines in the country. These wheels have carried over 18,600 hp in actual operation, so that they are also among the highest-powered turbines of the world. The exciters are mounted on the main units, thus obviating the use of separate water-wheels and penstocks and making for higher overall efficiency of the plant. Energy is transmitted over steel tower lines at 110,000 volts to substations at Atlanta, Newnan, Lindale, Gainesville and Cartersville, which are all of the outdoor type, that at Atlanta being the largest outdoor substation thus far built.

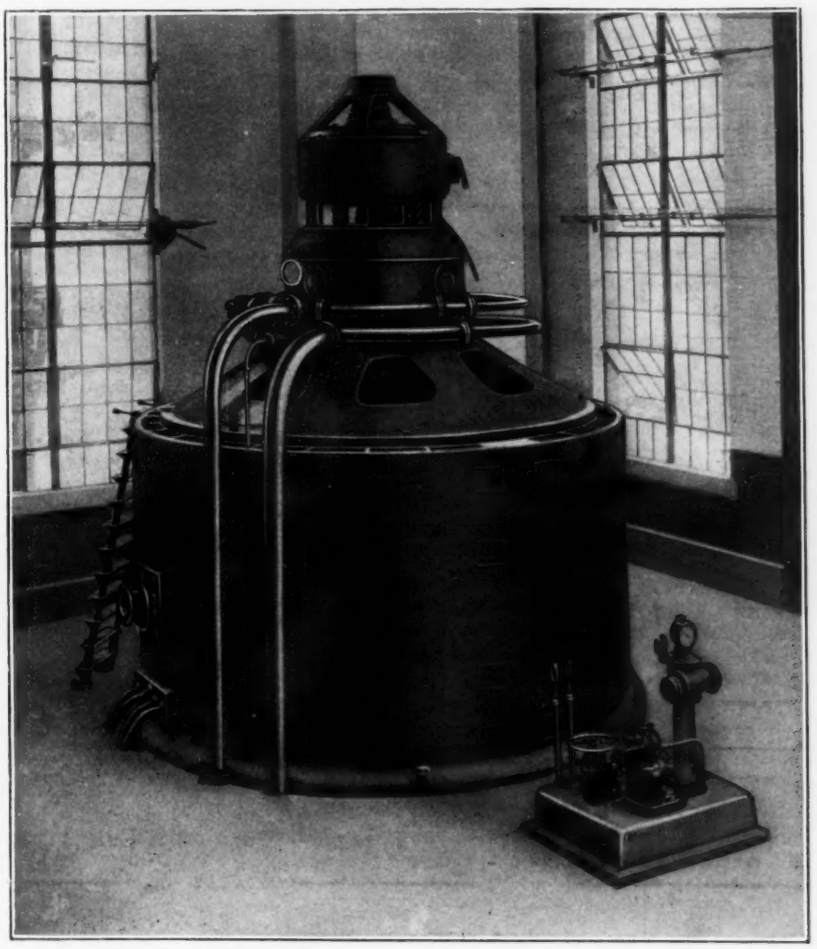


FIG. I—ONE OF THE MAIN GENERATING UNITS AT TALLULAH FALLS, GA.

The Tallulah Falls development includes the construction of a solid masonry dam, 110 ft. high, situated above the Ladore Falls of the Tallulah River; a concrete-lined tunnel through rock for a distance of 6670 ft., having a net sectional area of 151 sq. ft., a structural steel reinforced forebay and surge tank; five steel penstocks, each 60 in. in diameter and 1200 ft. long, with provision for the future installation of a sixth penstock, and a power plant containing five 17,000-hp vertical-shaft, spiral-case-turbines, each directly connected to a 10,000-kw generator, space being provided for the future installation of the sixth unit. The power plant is situated in the gorge about 600 ft. below the top of the bluff, and to facilitate the delivery of apparatus to the plant an inclined railroad with complete hoisting equipment was constructed leading from the terminal of the railroad above to landing platforms at the entrance to the power house.

At the rear of the power plant and connecting with it is a transformer and high-tension switch house from which the delivery of electrical energy is controlled.

A storage dam is under construction about 6 miles above the Tallulah Falls development which will create a reservoir having a storage capacity of 1,250,000,000 cu. ft. This dam is of the reinforced concrete deck type with concrete buttresses and reinforced concrete apron on the downstream side over the spillway section. Provision is made within this dam to install a small power plant which will utilize the energy of the water which is released from storage.

The construction of the various parts of the development, especially the rock excavation at the dam site and in the tunnel, demanded the use of a great amount of compressed air. A temporary compressor plant was built 600 ft. down stream from the entrance to the tunnel, where a timber dam 8 ft. high and 60 ft. long was erected. This plan enabled the construction of a development having a 48-ft. head.

This dam created a pond about 600 ft. long with an average width of 125 ft. The intake for the penstocks was located at one end of the dam and was provided with suitable headgates and racks. A penstock 7½ ft. in diameter and 80 ft. long brought the water from the dam to a 1000-hp turbine which drove two air compressors, each rated at 2500 cu. ft. of free air per minute. There was also a 3-ft. pipe feeding the turbine which operated two 50-kw generators used for lighting the tunnnel. Air was compressed to 110 lb. pressure and distributed to the several workings in

the tunnel through a pipe 8 in. in diameter at the compressor plant. The pipe line was laid above the tunnel on the surface of the ground and was provided with branches leading through the adits and shaft to the drills, the size of the pipe reducing as branches were taken off.

The amount of air from these two compressors was not always enough for construction purposes, and an auxiliary

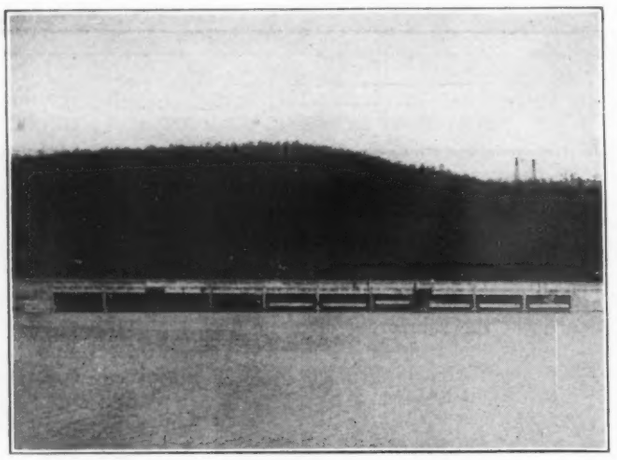


FIG. 2—MAIN DAM, SHOWING SWINGING FLASHBOARD COUNTERWEIGHTS

steam-driven compressor with a rating of 1500 cu. ft. of free air per minute was installed near the lower end of the tunnel to assist the water-driven compressors. When not required for this service the steam plant furnished air for the drills at work on the power-plant site.

Main Dam and Automatic Swinging Flashboards at Tunnel Intake

The intake dam is a rubble concrete structure of the gravity type arched to a radius of 900 ft. The maximum height of the dam is 110 ft. above the original ground surface, with footings on solid rock from 10 ft. to 20 ft. below; the crest length is 444 ft., and the total length of spillway is 280 ft. divided into ten sections, 28 ft. between piers.

The spillway is fitted with automatic swinging flashboards hinged on the lower edge and controlled by rolling counterweights so arranged and designed that the elevation of the water back of the dam will be maintained within 3 in. of the normal elevation of 1500 when passing a flood discharge of 12,000 cu. ft. of water a second. The counterweights are concrete cylinders 26 ft. long by 3.25 ft. in diameter and are fitted at each end with heavily geared rolling contacts which roll on specially curved racks attached to the side of the piers above the crest. As the flashboards are lowered, owing to the pressure of the water, the counterweights are forced to roll up the incline by the pull of galvanized-steel cables wound on a drum at either end of the counterweight and connected to the top of the flashboards.

The piers on the crest of the dam between which the flashboards are placed carry a highway bridge made up of plate girders embedded in concrete, having a 12-ft. roadway and platforms for hand-operated hoists for manipulating the flashboards should this be desirable when the water is drawn down or to enable the station operators to control the water at some other elevation than that which the flashboards are designed to maintain. The hoists serve also to manipulate two sand gates in the dam.

The footings of the dam were excavated below the riverbed and at each end of the dam until solid and homogeneous rock was exposed. The earth and rock excavations necessary to secure suitable foundations amounted to 10,000 cu. yd.

The rubble masonry in the dam is made up of concrete mixed in the proportions of one part of Royal Portland cement, three parts of sand and six parts of crushed rock in which rocks or "plumbs" which could be easily handled by derricks were embedded. The Royal Portland cement was manufactured by the Dixie Portland Cement Company at Richard City, Tenn., each car being thoroughly inspected, and samples from each car were tested in accordance with the standard tests of the American Society for Testing Materials. The total amount of concrete in the dam is 38,000 cu. yd., and the work was placed at the rate of about 800 cu. yd. to 1000 cu. yd. a week.

Storage Dam

The storage reservoir, situated near Mathis, about 6 miles above the dam at the intake works, will be formed by the construction of a reinforced-concrete dam of the Ambursen type, 90 ft. high and about 700 ft. long, across the riverbed, and a dike dam of the same type of construction across a depression about 50 ft. below the crest of the concrete dam and the elevation of the water in the reservoir. These dams will raise the water in the reservoir to elevation 1689, and the storage thus created will impound 1,250,000,000 cu. ft. of water.

The main reservoir dam will have thirty-three buttresses, spaced 18 ft. center to center, and the footings of the buttresses are approximately 6 ft. to 10 ft. below the original ground level. The horizontal joints of each buttress where thinner sections rest on thicker sections below are made up with raised keys so that there can be no possibility of horizontal sliding.

The reinforced-concrete deck which is carried on the upstream faces of the buttresses is of the arched beam type

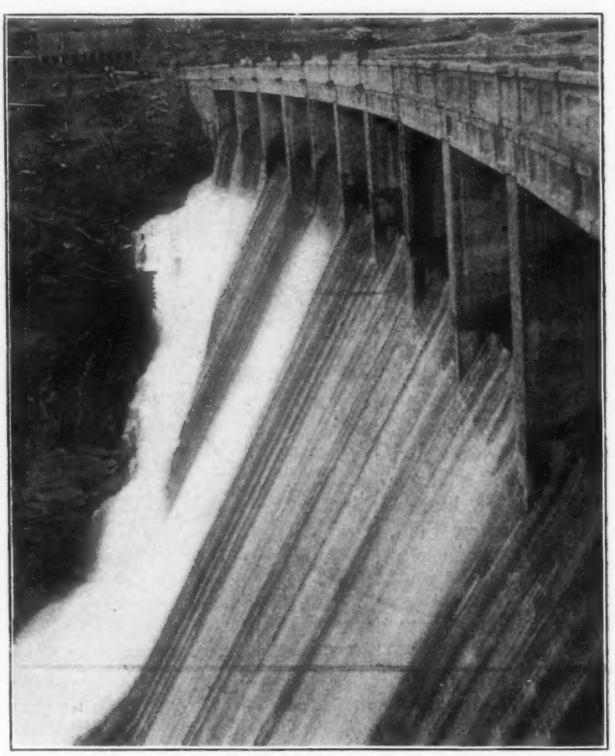


FIG. 3—DOWNSTREAM SIDE OF INTAKE DAM

of construction, the face of the deck being flush with the upstream faces of the buttresses. The thickness of the deck at the crown of the arch is 39 in. at the bottom and 18 in. at the top. The deck is sealed with the river bottom by means of a cut-off wall, 4 ft. thick, which extends 10 ft. or 15 ft. below the original ground surface.

The spillway deck and apron are constructed of rein-

forced concrete and are designed to offer the least resistance to the passage of floods and at the same time protect the footings of the buttresses from undermining. The spillway apron is 18 in. thick. The crest of the dam will be divided into sixteen sections, each section being 16 ft. clear between piers, which are 2 ft. in thickness and which will carry a footbridge about 12 ft. above the crest of the dam.

The concrete in the structure is mixed in the proportions of one part cement, two parts sand and four parts crushed stone for the upstream deck, crest and spillway apron, and 1:3:6 for the concrete in the buttresses.

Three 48-in. hydraulic gate valves of special design are provided to drain the reservoir when necessary. These valves are equipped with gates having a straight lower edge and are fitted with machine-surfaced brass guides for the gate. This design was adopted as being the most suitable for throttling purposes.

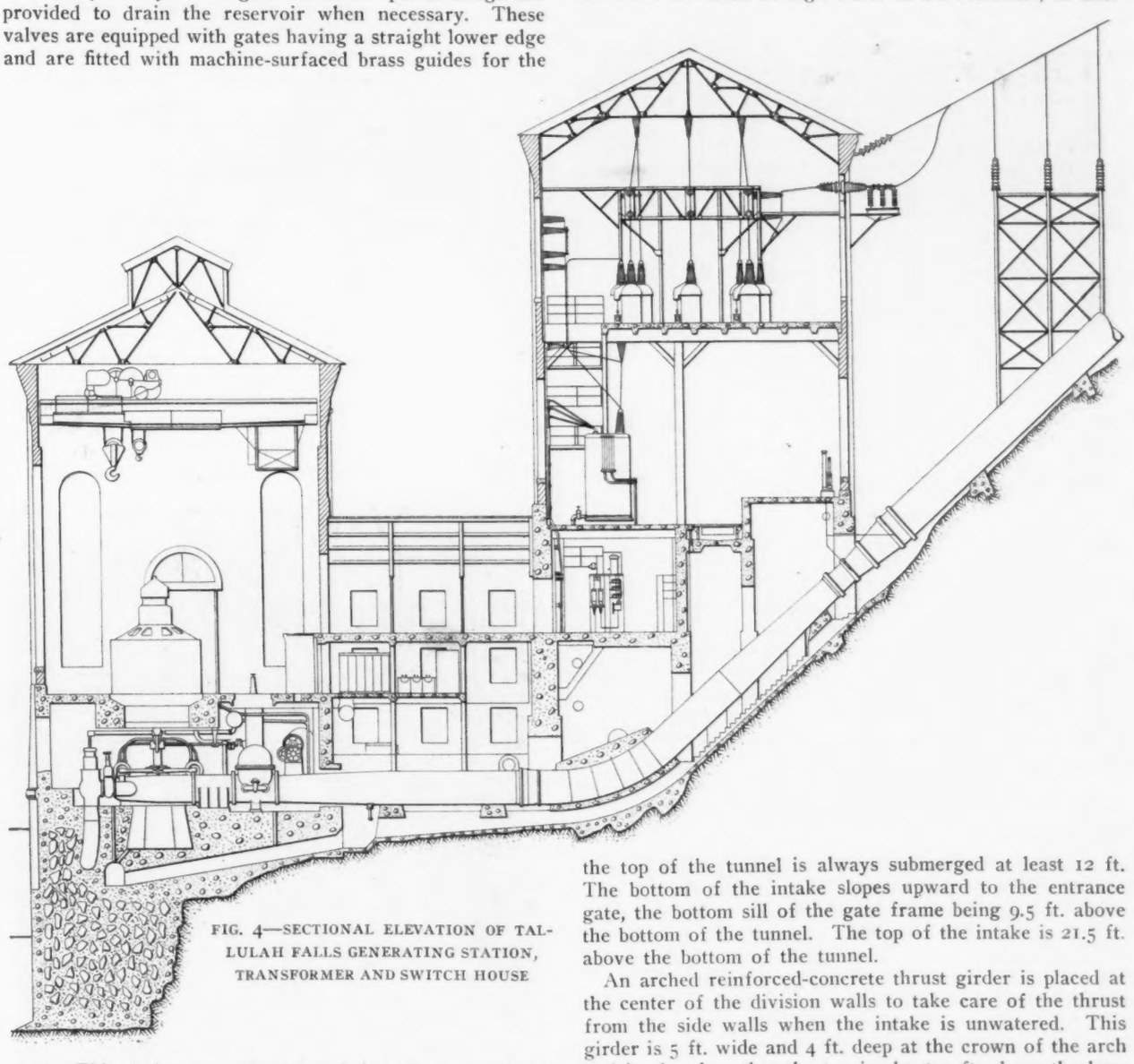


FIG. 4—SECTIONAL ELEVATION OF TALLULAH FALLS GENERATING STATION, TRANSFORMER AND SWITCH HOUSE

Provision is being made for the future construction of a power plant containing two 3000-kw units which will utilize the energy of the water drawn from storage and which will deliver the energy over a transmission line to the main line at the power plant below.

INTAKE

The intake forming the entrance to the tunnel is a reinforced-concrete structure 62 ft. wide by 38 ft. from front of intake piers to face of rear wall. The chamber is divided into five sections by concrete division walls, each section being provided with an 8-ft. by 10-ft. structural-steel gate with hoisting apparatus and racks having a screening area of about 375 sq. ft. per section or 1875 sq. ft. for the entire intake. The division walls are 3 ft. in thickness and are extended forward to form the intake piers. The piers are provided with stop-log grooves and are arranged so that it is possible to gain access to any gate for repairs when necessary. At the rear of each division wall there is an opening, 22 ft. high by 11.5 ft. wide, which allows the water to pass to the tunnel entrance at the center of the rear wall at the bottom. The bottom of the tunnel is 26.5 ft. below the elevation of low water and 46.5 ft. below the elevation of high water in the reservoir, so that the top of the tunnel is always submerged at least 12 ft. The bottom of the intake slopes upward to the entrance gate, the bottom sill of the gate frame being 9.5 ft. above the bottom of the tunnel. The top of the intake is 21.5 ft. above the bottom of the tunnel.

An arched reinforced-concrete thrust girder is placed at the center of the division walls to take care of the thrust from the side walls when the intake is unwatered. This girder is 5 ft. wide and 4 ft. deep at the crown of the arch and is placed so that the top is about 3 ft. above the low-water elevation in the reservoir, thus forming a platform from which the lower set of racks can be raked by hand in the two sections which are not provided with mechanical raking devices.

The gate hoists are hand-operated. One of the hoists is fitted with steel gears, the other four with cast-iron gears. The force is transmitted to the gate through structural-steel gate stems which pass through roller guide bearings.

The racks are made up of ⅜-in. x 4-in. flat bars, spaced 1⅝ in. center to center, and rest on 12-in. I-beams. The slope of the rack is 5 in. to the foot from the vertical. Two sections of the intake are fitted with two sets of racks each about 20 ft. long. The other three sections are fitted with

continuous racks and motor-operated, mechanical raking devices to remove débris, particularly during the season of the year when leaves are floating on the water.

Tunnel

A concrete-lined tunnel, 6670 ft. long, connects the intake with a forebay excavated in the rock. The tunnel section resembles a horseshoe in shape, the height being 14

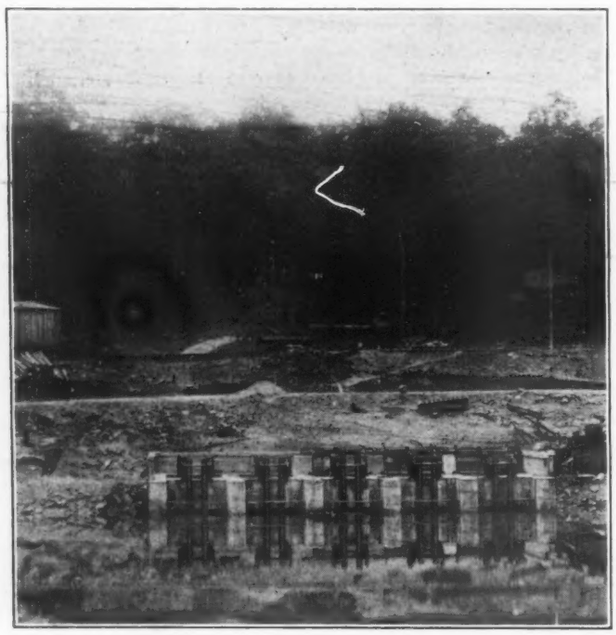


FIG. 5—INTAKE AND TUNNEL

ft. and the width 12 ft., with the top arch at a radius of 6 ft. The net sectional area is 151 sq. ft. It is lined with concrete for an average thickness of 18 in.

The tunnel has a maximum rating of 1555 cu. ft. of water per second, with a velocity of water of 10.3 ft. per second. The normal flow through the tunnel with rated load on all the units in the plant is 1160, with a corresponding velocity of 7.7 ft. per second.

To facilitate the construction of the tunnel one shaft and three adits were constructed. The distance from the entrance portal to the shaft is 1283 ft., from the shaft to the first adit 1443 ft., from the first to the second adit 1473 ft., from the second to the third adit 1011 ft., and from the third adit to the discharge portal 1460 ft. Thus the working of the tunnel was conducted through six openings, making ten headings. The shaft is about 100 ft. deep and about 10 ft. by 12 ft. in section. The adits are 7 ft. high by 13 ft. wide.

The excavation of the tunnel was accomplished by first excavating a heading 8 ft. high the entire length between adits and then excavating the bench. The rock encountered in places required special timbering and was of such a nature that the progress of the work was greatly delayed.

The concrete lining was placed around steel forms by means of a specially designed air concreting machine. The concrete was mixed in the proportions of one part Portland cement, three parts sand made from rolled crushed rock and five parts crushed rock. The total amount of concrete for the tunnel is estimated to be 18,000 cu. yd., the total yardage of excavation being about 60,000 cu. yd.

Forebay

The forebay at the lower end of the tunnel is designed to take care of the maximum surge due to the sudden closing of the gates of all the wheels when running at 25 per cent overload. It is estimated that during 25 per cent overload operation the elevation of the water in the forebay will be about 12 ft. below the elevation at the intake, owing to friction losses in the tunnel, and that if all the turbine gates are suddenly closed the resulting surge in the tunnel will raise the water in the forebay to about 29 ft. above the elevation at the intake.

The bottom of this forebay is about 63 ft. below the ground level and is 30 ft. by 71 ft. inside in plan and 93 ft. high. The walls of the forebay are of concrete reinforced with heavy structural-steel framework with cross-tie beams. An emergency gate, 7.5 ft. square, made of structural steel is placed at the entrance of each penstock at the bottom of the forebay. Each gate is swung on pin hinges on the top side and is held open by a chain passing over a hand-operated hoisting mechanism at top of the forebay.

Penstocks

From the forebay the water is conducted to the turbines through 60-in. penstocks. Five of these penstocks have been constructed, with provision for a sixth to be constructed at a later date. The penstocks are of riveted steel varying in thickness from 3/8 in. to 9/16 in. and are from 1200 ft. to 1258 ft. in total length from the forebay to the power plant. The greater portion of the penstocks are on grades exceeding 70 per cent, the maximum grade being 150 per cent.

At the upper end of the penstocks remote-controlled, motor-operated gate valves, 60 in. in diameter, are provided. These valves are furnished with limit switches and are operated from the power plant.

At the lower end of the penstocks a heavy anchorage casting of cast steel is solidly embedded in the concrete of the power house and connects with the turbine casing on one side and with a hydraulically operated gate

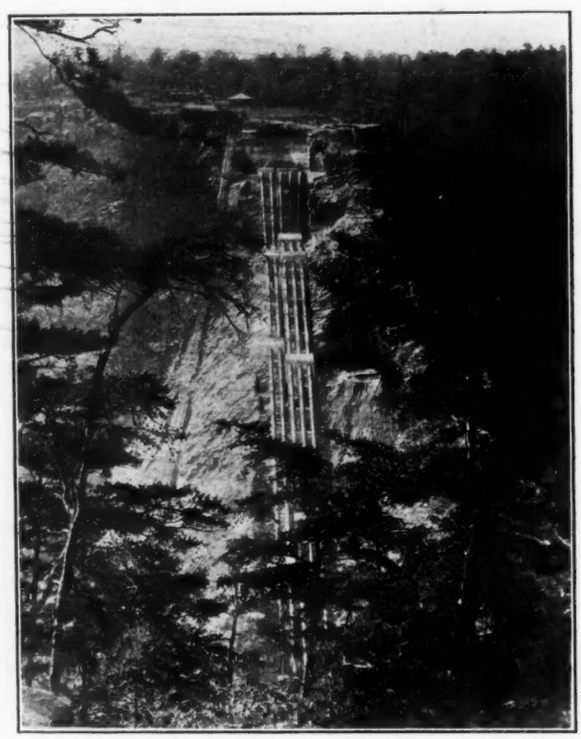


FIG. 6—FOREBAY AND PENSTOCK

valve on the other side. These anchorages are designed to take the thrust from the penstocks and thus relieve the wheel cases from stresses tending to impair their alignment.

The hydraulically operated gate valves are 45 in. in diameter and are fitted with leather-cup ring-packed pistons. These valves are furnished with a pilot or operating valve so designed that the gate can be held in any position desired

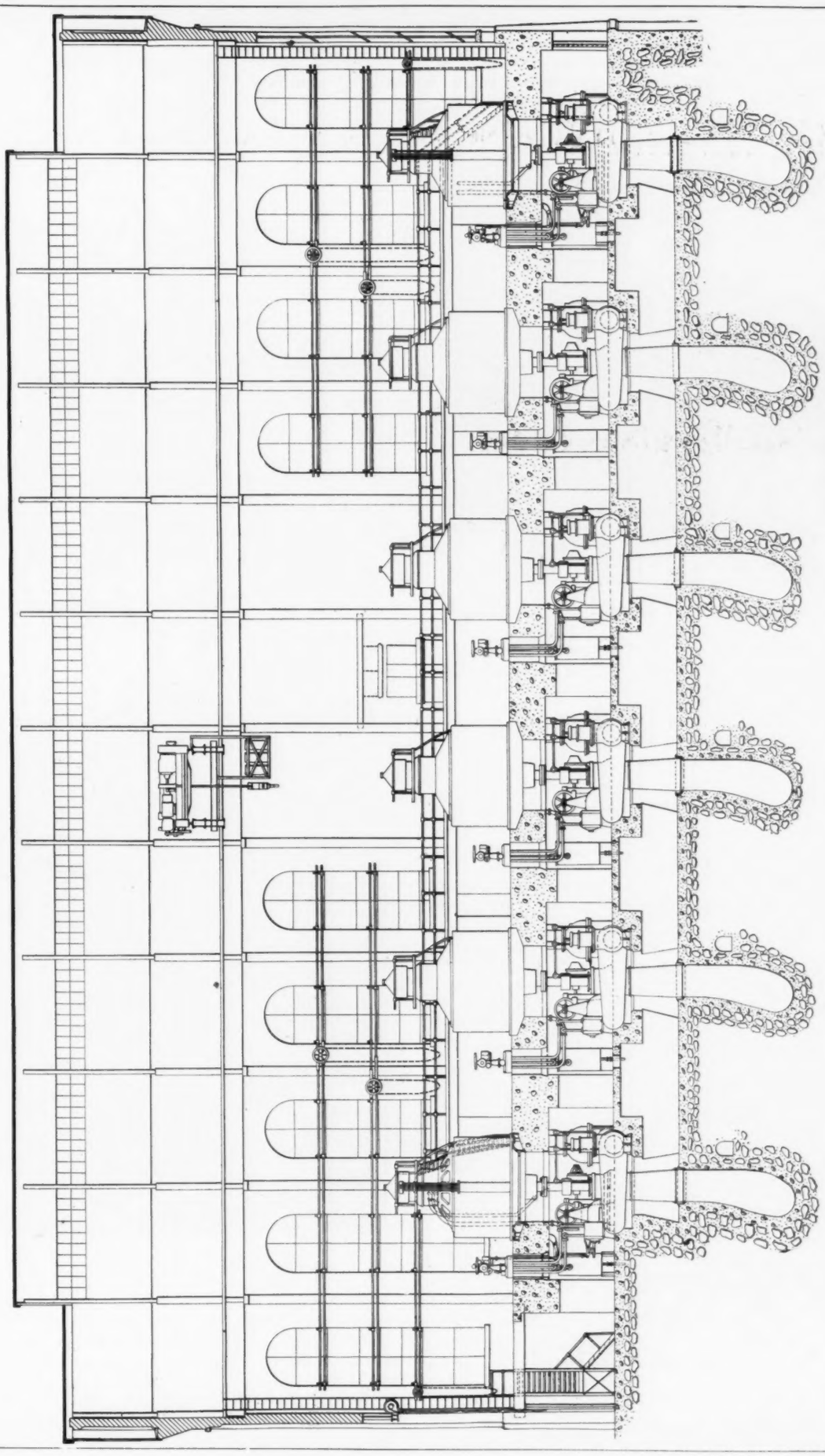


FIG. 7—LONGITUDINAL ELEVATION OF GENERATING STATION OF THE GEORGIA RAILWAY & POWER COMPANY AT TALLULAH FALLS, GA.

by the operator. The hydraulic pressure in the cylinder for operating the valve is that due to the head of the water in the penstock.

Above the hydraulic gate valve and just outside the power plant a Venturi meter with 35-in. throat is installed in each penstock. The indicating and recording instruments are located in the switch house.

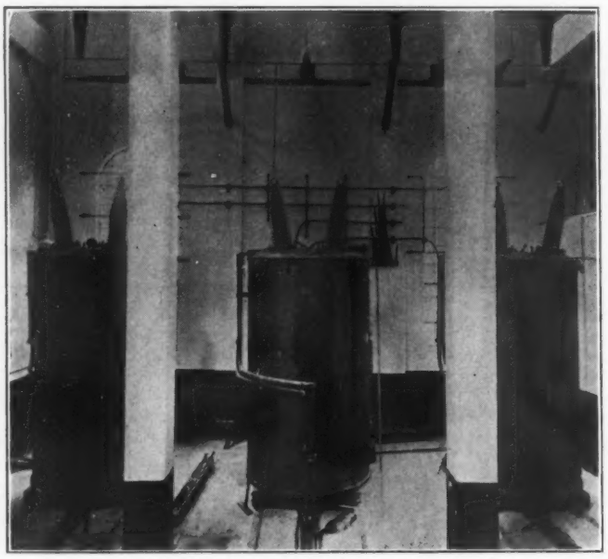


FIG. 8—HIGH-TENSION TRANSFORMER ARRANGEMENT

The penstocks are carried on concrete piers spaced about 32 ft. center to center. At or near each change of grade a heavy concrete anchorage block is provided for each straight section over 100 ft. in length.

Power Plant Buildings

The general arrangement of the buildings, which include the main power house and a transformer and high-tension switch house, resembles a letter H. The power house faces the tailrace excavated in the riverbed. At the rear of the power house, and separated from it by a clear distance of 28 ft., the switch house is situated, these two buildings being interconnected by a small building containing the switch-control apparatus. By this arrangement ample light is admitted on all sides of the principal buildings.

The main power house is 192 ft. long by 48 ft. wide and contains space for six main units spaced 28 ft. center to center. The lower chords of the roof trusses are 49 ft. above the generator-room floor. Massive concrete construction was used for the foundation, the walls being of concrete to an elevation 1½ ft. above the main generator floor. The generator-room floor is constructed with heavy steel girder beams to distribute the load from the generator frames, and the concrete is monolithic with the side walls.

The structural-steel framework of the building rests on the concrete foundation walls. A plate girder runway is provided for a 60-ton crane. The roof trusses are of the Fink type and support purlins having 15.5 ft. span, on which the roofing tiles are laid directly.

The side walls of the power house are constructed of red brick with marble pilaster caps and windowsills. The roofing is of reinforced-concrete tile construction colored red to harmonize with the coloring of the side walls. The roofing tile is designed to rest directly on purlins spaced 4 ft. center to center and is arranged to seal weather-tight on all edges. A monitor extends nearly the entire length of the ridge of the roof and contains about 1200 sq. ft. of window area.

The windows are of the "Fenestra" steel-type sash, glazed with selected double-thick American sheet glass. The monitor sashes and about half of the other sashes are operated by the Drouvé system of window operators. Rolling steel doors are provided at the principal entrances. Steel stairways and railings are located at convenient places extending from floor to floor.

A gallery 155 ft. long, with a stairway at each end, is provided along the back of the generator room, which forms the roof of the rheostat rooms and from which the operator commands a good view of the operating floor.

The basement of the turbine room contains the complete turbine unit together with the pressure pumps and gate-controlling mechanism. The generator-room floor above supports the frames of the main generators and the superimposed thrust bearings which carry the entire revolving parts of the machines.

The transformer and high-tension switch house is 250 ft. long by 50 ft. wide and is situated on the side hill of the gorge back of the power house so that the front wall is 25 ft. to the rear of the back wall of the power house.

The transformer room is above the low-tension room, the elevation of the low-tension switch-room floor being the same as that of the gallery in the power house. This room provides space for eighteen transformers.

The high-tension switch room is located over the transformer room and contains all the high-tension switching gear of the station, as well as the high-tension buses from which the electrical energy is taken out to the transmission lines.

The general construction of the building is similar to that of the main power house, except that there is no monitor and the roof trusses are of a special design with a raised cord to provide space for the necessary buses without unnecessarily raising the walls of the building.

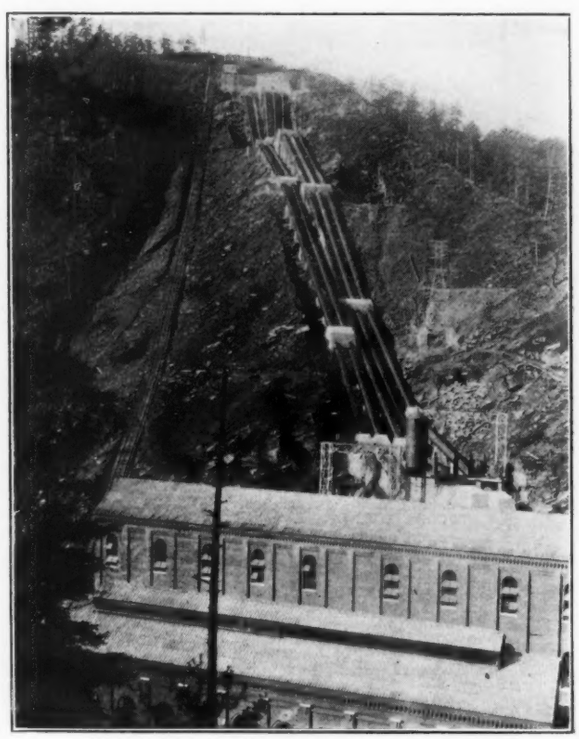


FIG. 9—GENERAL VIEW OF GENERATING STATION

A straight-flight steel stairway with landings connects all the floors. A traveling trolley hoist electrically operated has been installed for raising material to the upper floor. The transformers are placed on one side of a track which forms the runway for a transformer truck.

The first floor contains a 250-kw Pelton waterwheel, tapped off from the penstocks, which is used to run an

auxiliary exciting generator, and also a small compressor plant for the supply of air for cleaning and other purposes. The second floor, which is at the same elevation as the generator room of the power house, contains lavatory fixtures and lockers. The upper floor, which is at the same elevation as the gallery in the power house, into which it opens, and as the low-tension switch room in the switch house, contains the switching gear for controlling all the main switches throughout the station.

HYDRAULIC MACHINERY

The prime movers of the power plant consist of five S. Morgan Smith Company 17,000-hp vertical-shaft turbines of the Francis type with scroll cases. Space is provided for a sixth unit, making the ultimate generating capacity 102,000 hp.

The turbines are designed for an average head of 600 ft. and operate at 514 r.p.m. Each turbine is provided with an oil-pressure governor, twin-gate operating cylinders and a heavy walking beam to operate the gates. A relief valve of special design to discharge about 70 per cent of the water in case of a sudden closing of the gate is connected

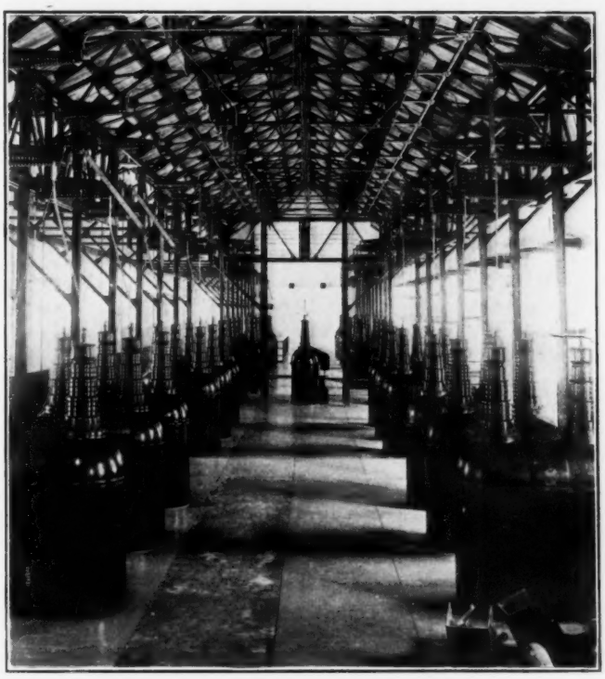


FIG. 10—HIGH-TENSION SWITCH ROOM

to the scroll case of each turbine on the same center line as that of the penstock connection.

The runners are of special design and are of bronze, while the gates are of forged steel with bronze-bushed pivot bearings and bronze-lined packing glands. Selected cast iron was used for the scroll cases, which were cast in one piece and each case tested under 400 lb. hydraulic pressure per square inch. Each case is about 14 ft. outside diameter and contains about 28 tons of metal. Each turbine discharges through concrete draft tubes lined with steel plate of such design that the water is delivered to the tailrace with minimum disturbance of the water. The normal draft head on the runner is 22 ft.

The general arrangement of each prime mover consists of the turbine runner, the rotating field of the main generator and the armature of the exciting generator, each superimposed above the other on the vertical shaft and the whole carried by an oil-pressure thrust bearing at the upper end of the shaft, with the exception of the exciter, which is above the thrust bearing. There are two guide bearings, one above the turbine runner and one below the generator armature. The shaft is made in two sections of nickel steel and with forged steel flanges and tapered flange bolts fitting into concentrically reamed holes. The governor pump and the pump for supplying oil to the thrust bearings are driven by worm-gear-driven counter shafting in the generator-room basement. Each unit is fully equipped with its own governor and thrust-bearing pumps, the thrust-bearing pumps being interconnected so that the pumps can be operated interchangeably.

The six main generators are of the General Electric Company's vertical types rated at 10,000 kva, 514 r.p.m., 6600 volts, 60 cycles, three-phase, with 100 kw, 250-volt exciters on the dome of the main generators. Each exciter is capable of exciting two generators at its full load. These machines have a flywheel (WR^2) effect of 1,250,000 ft.-lb. The revolving field is made up of solid sheet steel disks bolted together.

The switchboards are placed on the top floor, overlooking the main operating room of the switch-control house which joins the generator building to the switch house. A bench-board contains all the control switches, mimic buses, signal lamps, etc., and directly in the rear are vertical instrument panels containing indicating and integrating instruments.

The exciter switchboard is on the main floor of the generating room, directly under the control panels. Directly opposite each generator is a panel containing the field resistor dial, remote-control field-switch operators, signals, etc.

From the generators the main cables are carried to the adjoining switch house and connected through their respective oil switches, buses, etc., to the step-up transformers. Three 3333-kva single-phase transformers per generator group transform the voltage from 6600 volts to 63,500 volts, giving 110,000 volts to the line potential when Y-connected. From the high-voltage terminals of the transformers the energy is carried through high-tension oil switches, buses, etc., to the outgoing lines. The neutral of these transformers is connected through a neutral resistor at the end of the switch house.

The entire station control is centered about this point, and it is possible by the use of remote-control apparatus to control the operation of all the main apparatus in the station. The generator rheostats are placed under a gallery entirely isolated from the main operating room and ventilated with suitable louvers, so that the heat can be readily carried away.

In the main generating station the entire excitation is taken from the direct-connected exciters, there being no motor-generators or water-driven exciters, thereby eliminating the need of complicated hydraulic connections in order to select any particular penstock.

The scheme of isolating each generator has been carried out, and the low-tension transfer bus is the only connecting link between the generators in the low-tension switching room. These oil switches are mounted in groups and separated about 20 ft. from each other. The high-tension 110,000-volt bus is carried from the roof trusses of the high-tension switching gallery, the trusses being of a special design in order to give sufficient clearance for the wiring. By this type of truss it is possible to cut down considerably the height of the building and use the usual waste space for wiring. The high-tension wiring is carried from the switch house through a new type of line entrance bushing specially developed for this plant, and it requires no exterior protection from the weather other than the bushing itself. On the exterior of the building there is an extension of the interior bus, making it possible to supplement the interior bus in case of trouble to bushings, insulators, etc. All the high-tension electrolytic arresters, horn-gaps, etc., are mounted on a structure built on the side of the hill adjoining the switch house.

In a subsequent article the transmission line and semi-outdoor substations, that at Atlanta being the largest in the world, will be described.

Ornamental Lighting in Residential Districts

Series tungsten system covering all streets of Champaign, Ill.—Underground and overhead distribution. By J. R. Cravath

THE artificial lighting of down-town streets by means of ornamental lamp standards has become extremely popular among progressive American cities and towns. Little has been done, however, toward the extension of such ornamental lighting over the streets of entire communities particularly in residential sections. For this reason the features of the complete system which

FIG. 1—CHAMPAIGN STREET LIGHTING, OVERHEAD SUPPLY

lights Champaign, Ill., a city of 15,000 people, should be of special interest to residents of similar small cities since it shows what can be done with a very limited amount of money.

Before the installation of the present system Champaign was lighted by the method typical of cities of its class in the Mississippi Valley, namely, inclosed alternating-current 6.6-amp series carbon arc lamps, spaced two blocks apart at every other street intersection. In the downtown district, however, some of the more enterprising merchants had joined together and erected thirty-six five-lamp standards of a familiar type. In 1911 the city voted bonds for $35,000 to install an ornamental street-lighting system, although, unfortunately, its City Council and citizens were insufficiently informed as to the extent and kind of a system which could be put in for $35,000. Accordingly several months later, in 1912, when the writer was retained to draw up plans, he was faced with the rather difficult problem of designing an ornamental system which would come within the appropriation and yet be creditable to the city. Instructions received from the Council were to place wires underground within the fire limits in the central part of the city and overhead in the residential sections.

Selection of Types of Construction

Extensive preliminary studies were first made of street-lighting systems in other cities. Special consideration was given to the excellent scheme in use at Toronto, Canada, using 24-ft. concrete poles about 110 ft. apart with a special design of lantern on each pole. In spite of the low cost at which these concrete poles were made in Toronto, it was found that they would be too expensive for the Champaign installation, and it was finally decided to use very light tubular steel poles.

Another problem was that of securing reliable underground construction for a series system operating at a maximum pressure of 2200 volts. Single-conductor lead-covered and steel-taped cable naturally suggested itself, but at the time these plans were being prepared only one installation of such cable on high-voltage series work could to the writer's knowledge be found in the United States, that at Charles City, Ia. Considerable doubt existed in the minds of many engineers whether the effect of the steel-tape magnetic circuit inclosing such a single conductor carrying alternating current would not set up so much reactance as to make the use of such cable out of the question. A special test made on the Charles City circuit, carrying 6.6 amp, showed, however, the total drop in pressure per 1000 ft. of No. 6 steel-taped 3500-volt cable to be 6.07 volts, of which about 2.7 volts was accounted for by the ohmic resistance, so that the use of this cable was found to be quite feasible.

The next problem was that of securing an ornamental design of lantern which should also be as efficient as possible. After considerable study a design was evolved which offered the advantages of a good-sized reflector, together with an artistic antique appearance, a combination apparently not heretofore available.

In the down-town district the plans called for sixty-four single-lamp standards, each equipped with a ball globe, a series socket and a 200-cp series tungsten lamp. All are within the fire limits and are supplied from single-conductor lead-covered and steel-taped underground cable. These sixty-four post lamps were installed simply to supplement the existing ornamental lighting and are placed on the less important streets not already lighted by the five-lamp clusters. The single-lamp standards present nothing new in design, since they consist simply of fluted pressed-

FIG. 2—CHAMPAIGN STREET LIGHTING, UNDERGROUND SUPPLY

steel columns with cast bases and tops equipped with 14-in. Alba ball globes having 8-in. necks.

Overhead Distribution in Residential Section

In the residential districts, where the wires are overhead, light tubular steel poles are installed. The commonest size of pole is 25 ft. long with a bottom section 3 in.

in internal diameter and a top section 2.5 in. in internal diameter. Although the same type of pole is employed for both lamps and lines, such light steel-pole construction would not be at all suited to a general distribution system as the poles are not heavy enough to permit natural increases in line capacity and there would be difficulty in working on live lines in the daytime. For a street-lighting system, however, where the number of lines will always be limited to a few No. 6 wires, and where the energy is off during the daytime, this objection does not hold. These light poles are unobtrusive and render the street-lighting circuits as inconspicuous as it is possible to have them with overhead construction.

All sections of the overhead system are designed to be easily converted into an underground system wherever the property owners along any given street desire to pay the cost of making the change. In such an event cast-iron bases can be slipped around the bottoms of the poles, these bases being used to cover the entrance of the underground cable.

In the overhead districts the general plan has been to locate 100-cp series tungsten lamps at the street intersections and 60-cp series tungsten lamps midway between street intersections on the longest and the most important blocks. As it was not feasible to locate lamps midway of all blocks, some uniform rule had to be adopted for locating these mid-block lamps. This rule was as follows: On blocks over 400 ft. between street centers one lamp was placed in the middle of the block provided that there were eight houses fronting on the street or that the street was important enough to be paved. In case the system is later changed to underground each of the present overhead-line poles can be made to carry a lantern with a 32-cp lamp, or such additional lamps can be added with the present overhead distribution. The system selected therefore offers great flexibility.

The design of lantern and bracket used comprises a cast-iron lantern top into which is screwed a 1.25-in. standard pipe, bent as shown in the illustrations, to form a bracket with the aid of a curved brace. The lantern top contains a porcelain series receptacle and film cut-out of the General Electric type used on exposed work. The size of the cast-iron top is such as to cover and render inconspicuous the 18-in. flat white enameled-steel reflector. A cylindrical Alba lantern globe, 8 in. in diameter and 8 in. high, is held up against this reflector by four long bolts passing through a cast-iron ring into which the bottom of the globe fits. The flat reflector is placed low over the lamp so as to intercept as much of the upward light flux as possible.

FIGS. 3 AND 4—STANDARD FOR SIDE-STREET LIGHTING AND STANDARD FOR TYPICAL RESIDENCE STREET

The distribution of light about this type of lantern equipped with a 60-cp series tungsten lamp, as compared to a 14-in. upright Alba ball globe with the same lamp, is shown by the accompanying photometric curve, based on tests made by the Electrical Testing Laboratories of New York. This curve shows about 18.5 per cent greater candle-power at an angle of 75 deg. from the vertical with the lantern than with the plain ball, and an increasing percentage at angles nearer the vertical.

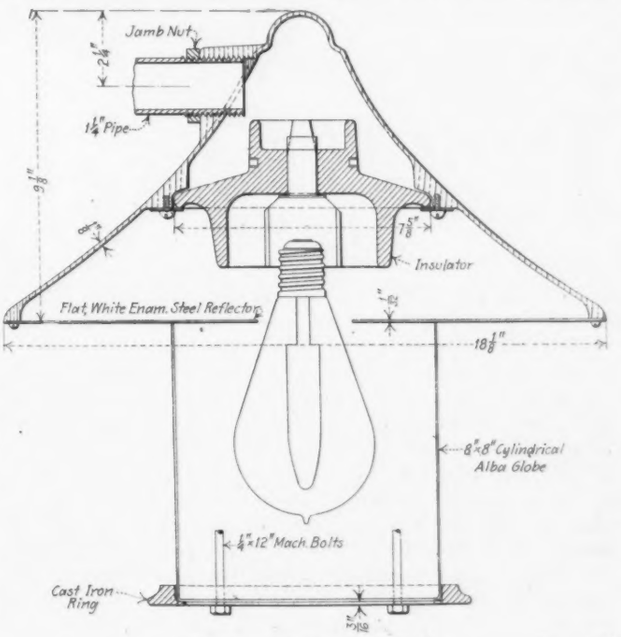


FIG. 5—DETAILS OF LAMP

In most series incandescent-lamp fixtures which have the wires concealed in the pipe of the bracket a weak point of insulation results where the wires enter the bracket. Special attention was given in the present design to securing good insulation at the point of entrance, while at the same time having the bracket present a neat appearance. Duplex 3500-volt cable is used inside the bracket, and where the cable leaves the bracket a special joint of compound and tape is made up as shown in the sketch. Where this design of lantern bracket is used with underground work the duplex high-tension cable is provided with similar joints at the top of both the pipe bracket and the pole, while a porcelain disconnecting series pot-head is used in the base of the pole.

UNDERGROUND CONSTRUCTION AT PRIVATE EXPENSE

The system as originally designed (and upon which the successful bidder submitted a proposal bringing the total cost within the $35,000 appropriation) called for sixty-four 200-cp lamps on single standards, with underground supply, 331 lanterns with 100-cp lamps, and 252 lanterns with 60-cp lamps, making a total of 583 lanterns with overhead supply in the residence districts.

After the contract had been let to the successful bidder, the property owners on some of the best residential streets asked permission to put in an underground system and pay the extra cost involved. This permission was granted in all cases, but with the provision that the plans for the underground system should be approved by the city's engineer. In order to secure uniformity, a rule was adopted requiring all lanterns in the residence district to follow the standard pattern already designed. For those residence

streets in which underground lines were installed at the outset a new post was designed resembling in general the overhead posts but provided with a cast-iron base resting on a concrete block, instead of the usual tubular steel embedded in concrete. This underground-type post is 16 ft. high, or 4 ft. shorter than the regular overhead poles. Where these posts are installed on residence streets with

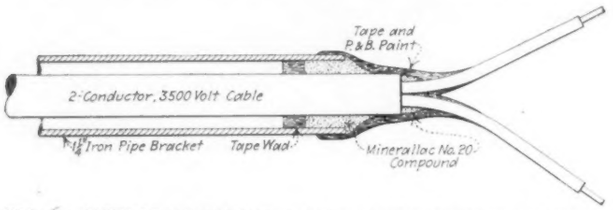


FIG. 6—METHOD OF TAPING CABLES AT TOP OF PIPE BRACKETS

underground wires they are spaced approximately 150 ft. apart along each curb line, making one lamp for each 75 linear feet of street. Necessarily some slight variation has occurred from this spacing on account of the length of the city blocks and also because of various obstructions. The rule was made, however, not to permit lamps to be placed on both sides of the street unless property owners were willing to stand the expense of a lamp-post for every 75 linear feet of street, as it had already been demonstrated by certain tests in Chicago that unless such a spacing as this could be maintained it would be better to have all the lamps on one side of the street. In the residential underground districts, as just described, the lamps are all of 32-cp rating. The energy required per mile of street is therefore between 25 per cent and 30 per cent more than with the typical arrangement in the overhead districts, but by reason of the more frequent spacing of the lamps the minimum illumination on the street is about four times that in the overhead district. The city operates these additional underground lamps without extra expense to the property owners in consideration of the increased installation expense already borne by them.

SUMMARY OF SYSTEM INSTALLED

The street-lighting installation as finally completed consists of 309 100-cp lanterns and 218 60-cp lanterns supplied by overhead wires; 156 32-cp lanterns in the residential

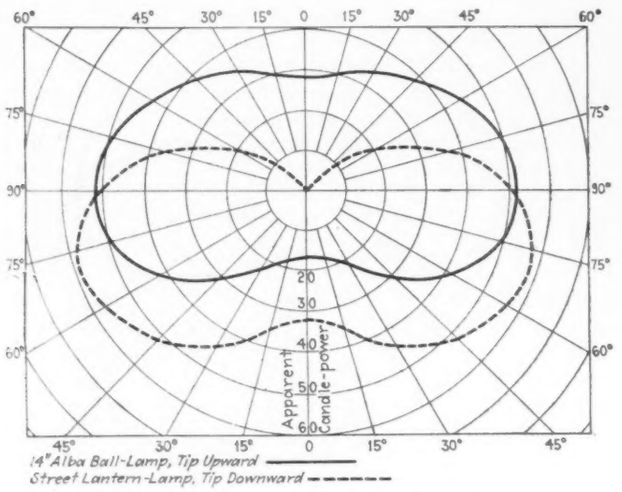


FIG. 7—DISTRIBUTION ABOUT 60-CP LAMP WITH BALL GLOBE

underground district, and sixty-four 200-cp lamps in ball globes on single-unit standards in the downtown district. These lamps are all supplied from 6.6-amp, 60-cycle, series, alternating-current circuits.

A concrete-block substation was also built by the city on a small triangular piece of property at the intersection of two streets near a railroad yard. Energy is obtained over a three-phase feeder from the power house of the Urbana & Champaign Railway, Gas & Electric Company, not far distant. The substation contains eight "A-W" series regulators, one for each street-lighting circuit. Allowance was made for growth on all the circuits. It is not intended to operate any circuit at a pressure over 2200 volts. The regulators are without moving parts, and the substation is operated without any regular attendant. The city purchases its energy at the company's bus, paying 2 cents per kw-hr.

All of the construction work was done under a general contract by a company now known as the Caldwell Electric Company of Champaign, Ill., under the supervision of the engineer for the city.

"Lighted Way" for the World's Wealthiest Town

The Boston suburb of Brookline, famed as the wealthiest town in the world, inaugurated a "White Way" system of street lighting on Nov. 3, when forty-five 6.6-amp luminous-arc lamps of General Electric design were placed in service by the Boston Edison company in the district be-

NEW LUMINOUS-ARC UNIT, AND OLD STREET GAS LAMP BEING REPLACED ON "LIGHTED WAY," BROOKLINE, MASS.

tween the Parkway and Harvard Square. Unusual publicity was accorded the opening of the service by the installation of nine reflector lamps and a special billboard upon the front of the most conspicuous building in Village Square, by the local newspaper "write-ups," and by a band concert, moving-picture show and parade on the night when the current was turned on. Each of these new street-lighting units consumes 510 watts and is mounted on a wooden pole 17 ft. high. The accompanying photograph shows a "gas arc" lamp displaced by the new installation and also the "Lighted Way" celebration notice. As the opening occurred at the height of the gubernatorial campaign, the occasion was utilized by one enterprising candidate as an opportunity to win proselytes to his standard, and the aristocratic old town had a lively evening. The system is to be greatly extended in the near future.

Storage-Battery Control by Counter-Emf Cells

The 150-cell, 5750-amp-hr. stand-by installation of the Union Electric Light & Power Company, St. Louis, Mo., employing remotely controlled short-circuiting switches

COUNTER-EMF cells provide voltage regulation for a 150-cell, 5750-amp-hr. standby storage battery in use by the Union Electric Light & Power Company, St. Louis, Mo., remotely controlled magnet switches being used to short-circuit in succession the subtractive counter cells, thus raising the effective terminal voltage of the battery.

The battery does not float on the line but is automatically thrown onto the system when needed by low-potential relays. Meanwhile the battery receives no preliminary voltage adjustment except the cushioning action automatically interposed by the counter cells.

Compared with end-cell systems of control, this counter-cell method avoids excessive copper construction in the battery room, eliminates expensive end-cell switches and works all of the active cells of the battery uniformly on both charge and discharge. In addition, a valuable cushioning effect is introduced by the counter cells, as illustrated by the fact that the battery can be thrown onto the system while its own terminal pressure is even 60 to 70 volts above the bus potential, without perceptible voltage variation of current flow.

CUSHIONING ACTION OF COUNTER CELLS

The counter-cell electrodes, although inert, unformed sheets of lead, acquire their counter-emf in a twinkling after being put in circuit, and build up to the difference in pressure, thus confirming the original expectation that it would be unnecessary to keep the counter cells "formed" or "charged" in order to secure the counter-emf action

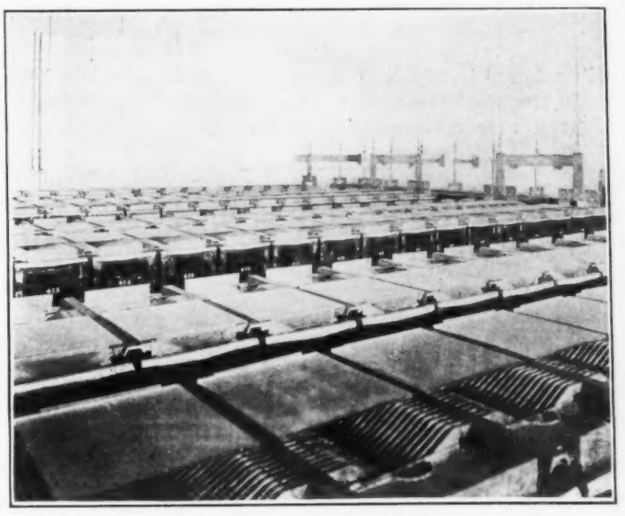


FIG. 1—INTERIOR OF STORAGE-BATTERY ROOM, COUNTER CELLS AT REAR

instantly when needed. The actual amount of active material built up on these counter-cell plates is, however, apparently very slight, even after extended use in the main circuit. As each cell is short-circuited it sets up an initial momentary rush of several thousand amperes, but this flow dies away almost instantly, leaving the cell inert. The total energy loss entailed in the counter cells is, of course, quite negligible, since the battery is discharged only in emergencies for standby service and the counter cells are all cut out when the battery is on charge.

The greater part of the energy dissipation in the two volts drop per counter cell appears in heating and dissociating the electrolyte, rather than in building up any amount of active material. The operation of the battery

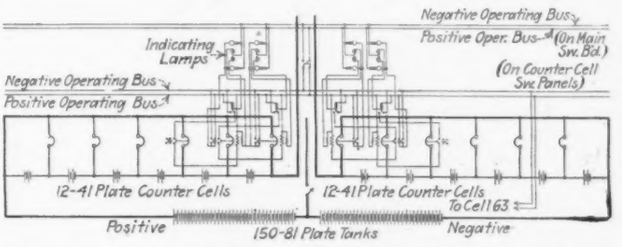


FIG. 2—CIRCUIT DIAGRAM OF COUNTER-EMF-CELL STORAGE-BATTERY CONTROL

under the most severe test conditions has also been altogether without incident, despite the many novel problems involved in its arrangement.

The accompanying diagram shows the arrangement of battery, counter cells and switches. The main battery comprises 150 Gould type T-61 lead cells, each containing sixty-one plates, with room for future increase to eighty-one if necessary. Wood spacers are used between plates and the tops of the cells are covered with heavy glass plates which largely collect and return electrolyte splashings and evaporation. Each 10-in. by 18-in. side plate has, however, a 4-in. semi-circular opening which admits inserting a hydrometer without raising the glass. The tanks, of 2⅛-in. wood lined with 8-lb. lead, measure 49 in. long, 23 in. wide and 49 in. high, giving ample "mud" clearance for even the whole positive plates to sludge away without causing short-circuit.

DETAILS OF CELL CONSTRUCTION

The tanks are supported on standard Gould oil-filled glass pedestals with porcelain bases, which in turn rest on cast-sulphur blocks coated with an acid-resisting paint to prevent disintegration of the sulphur. These blocks, poured in position on the floor, measure 7 in. by 15 in. and are 2 in. thick, and each supports two pedestals of adjoining tanks. Porcelain tiles are embedded in the sulphur. On these rest the 4½-in. porcelain cylinders, which carry the annular glass oil cups. Any electrical leakage which could occur must therefore cross these oil surfaces. Each tank is supported on six such pedestals, at a height of 15 in. above the floor, easily admitting the body of a man for inspection of the tank bottom. Tanks at the ends of the rows have five instead of three outer pedestal supports, to guard against settling and tipping.

Two 8-in. by 0.5-in. copper bars make up the main battery conductor, which is supported from the ceiling by rod hangers with double strain insulators. The copper bars are put together with steel bolts and nuts, over which, on the protruding threads, are screwed lead caps, the interior space being filled with vaseline. A 5-hp motor-driven fan exhausts air from the battery room through two 4 ft. by

3-ft. ceiling outlets, and a number of inlet registers on the far side of the room insure circulation when doors and windows are closed.

The 150 cells of the main battery are arranged in eight rows, and along the south wall are located the twenty-four counter-emf cells. Opposite each counter cell, but just outside in the substation room, are the corresponding short-circuiting switches. The counter cells are made up of unformed Gould spun-type plates, both sets alike, contained in forty-one-plate tanks, 34 in. by 22 in. Most of the counter cells contain fifteen plates, arranged in groups of eight and seven, but the last cells to be short-circuited have twenty-three plates and the next to the last twenty-one plates, thus affording greater carrying capacity for the cells in circuit longest. In mounting and construction the counter cells are similar to the main battery. The counter cells are short-circuited in groups of two, each pair being connected to its switch by two 4-in. by 0.5-in. copper bars. Slotted 10-in. by 14-in. slate slabs form the entries where the buses penetrate the wall, slate spacer-blocks making the joints air-tight. The short-circuiting switches are thus mounted outside and free of any battery fumes which might corrode their contacts or parts.

Remotely Controlled Switching Operation

As the sketch shows, these short-circuiting switches close across from the counter cell to the main bus conductor, thus gaining the advantage of multiple carrying capacity when more than one switch is closed. The switches are operated from groups of standard remote-control buttons on the substation switchboard. These actuate 220-volt relay coils on the switches, which in turn complete the operating-solenoid circuits. The switch mechanism, also locally designed, is of toggle construction and takes 30 amp while closing, but is held closed mechanically. Each switch is opened from the corresponding switchboard control button by a tripping coil reconstructed from a relay. Back contacts report the position of the switch to pilot lamps on the board. The switches are so interconnected that No. 1 must be closed before the actuating circuit of No. 2 is completed, and so on, in-

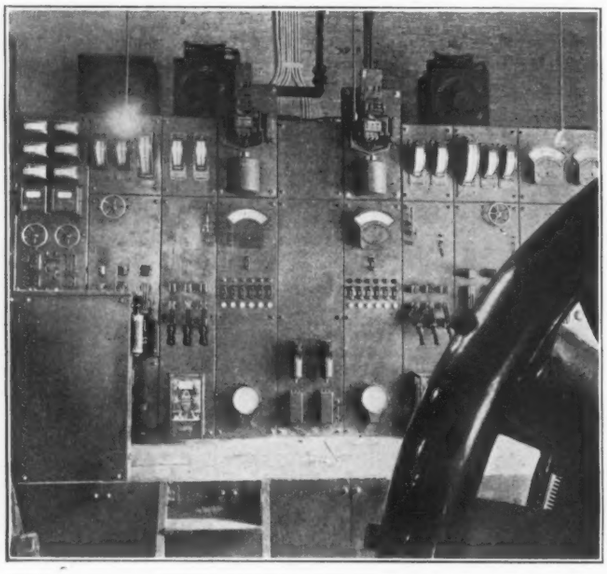


FIG. 3—SWITCHBOARD, SHOWING MAIN OPERATING SWITCHES

suring operation of the switches in their proper order. Each switch closes laminated-spring contact surfaces, 3.25 in. by 4 in., against the busbars. In emergency the switches can be hand-operated from the switch gallery.

The main battery leads are connected to the system through 12,000-amp Westinghouse solenoid-operated switches, arranged with low-voltage relays and hand control. When the 110/220-volt system pressure falls below the predetermined figure, these relays cause the main switches to close, at once connecting the battery to the line. This connection can take place with impunity, regardless of the voltage difference between line and battery, since the counter cells serve as a cushion, building up a reverse emf to prevent a sudden current rush. Even with

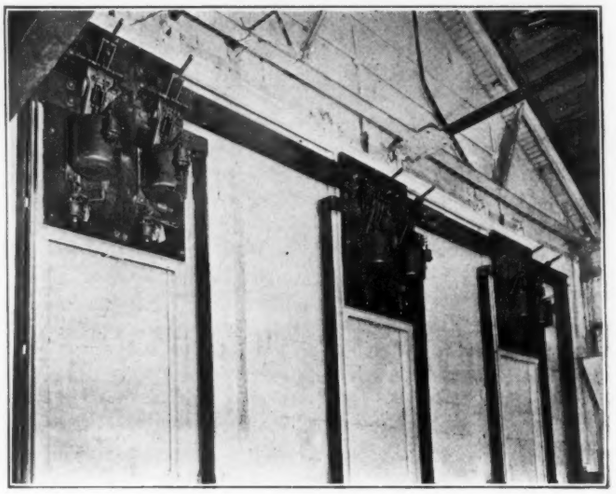


FIG. 4—REMOTE-CONTROLLED ELECTROMAGNETIC SHORT-CIRCUIT SWITCHES

the system at 240 volts between outers and the battery pressure 300 volts or more, connection has repeatedly been closed through the counter cells without appreciable voltage variation or current flow.

In succession, the attendant then short-circuits counter-cells until the battery is carrying its apportioned load. This rating is as follows: 5750 amp for sixty minutes; 11,500 amp for twenty minutes; 17,250 amp for ten minutes; 23,000 amp for six minutes. The capacity in kilowatts is: At the 5750-amp rate, 1500 kw; at the 11,500-amp rate, 1470 kw; at the 23,000-amp rate, 5865 kw.

This interesting counter-cell installation was designed and constructed under the direction of Mr. S. B. Way, now vice-president and assistant general manager of the Milwaukee Electric Railway & Light Company and formerly electrical engineer for the St. Louis Union Electric Light & Power Company.

Illumination Revision Produces Satisfied Customers

The Commonwealth Power Company, Jackson, Mich., is giving trial demonstrations of the best methods of lighting industrial establishments. Where a factory is insufficiently illuminated or the distribution is not suited to the work carried on, the electric company will, with the consent of the consumer, revise a portion of the lighting system and point out how the efficiency of human labor is improved thereby. These changes are made without charge, but the increased satisfaction of the customer resulting from the correspondingly improved operating conditions is a big asset to the company when capitalized as good-will. The fact that the utility company shows an interest in the illumination of his premises makes the consumer look toward it as an adviser. In many cases where a saving to the consumer has been effected by the revision enough extra lamps have been ordered installed for display purposes to bring the total energy consumption above the original demand. Besides securing satisfied customers through the improved lighting, the central-station company can make use of the revised installations as examples of model illumination in talking to prospective consumers.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Setting the Meter-Installation Pace

To stimulate its sales staff in their efforts to add new business at the rate estimated at the beginning of the year, a Southern central station has mounted a large pointer and dial in its salesmen's room, the periphery of the dial being marked off into a thousand divisions, each of which represents a meter the head of the department hopes to put into service during the present year. Each day as the records of the preceding day's business are received the pointer is advanced the corresponding amount, showing at a glance how nearly the staff is keeping up with the pace set for it. The scheme provokes the interest and enthusiasm of the men and, simple as it is, has been found well worth while by this company.

Flatiron Campaign at Defiance, Ohio

In the smaller towns of the Middle West the prevailing method of conducting flatiron campaigns seems to be to inaugurate a house-to-house canvass and offer the housewives electric irons on trial to be paid for at reduced rates. A modification of this style of campaign recently started by the Defiance (Ohio) Gas & Electric Company has met with more than a fair degree of success.

An agent who had had some experience in selling was engaged with the understanding that he was to receive a commission of 50 cents for each iron sold. He was then provided with a book containing blank forms such as the one shown in the illustration herewith. The order book was provided with alternate white and yellow forms, the white blanks being filed in the office and the carbon duplicates being retained by the solicitor to show the neighbors of the woman who had bought an iron.

As will be seen from the form, the iron is placed on trial

Defiance, Ohio, Aug 15 1913

DEFIANCE GAS & ELECTRIC CO.
SALES DEPARTMENT
410 CLINTON STREET
DEFIANCE, O.

Please deliver to my address one Type X Electric Flat Iron, with the understanding that I am to have a free trial for a period of two weeks. The price of this iron is $3.50 If I do not return the iron to 410 Clinton St., on or before 2 weeks you may charge $3.50 to my account, or I will pay $0.50 per month until the above sum is paid.

Sign here Mrs James Smith

Agent John Doe Address 112 Chancy St

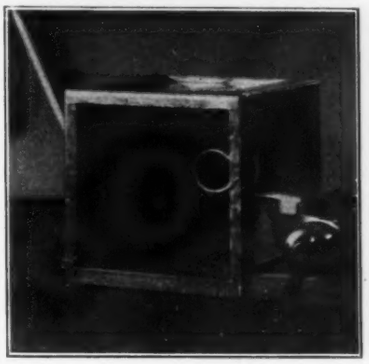
NOTICE—Pay no money to Selling Agent

FORM USED IN IRON CAMPAIGN AT DEFIANCE, OHIO

and if it is not returned to the office within two weeks the price, $3.50, is charged to the customer and made payable at the rate of 50 cents per month. At the end of two weeks 125 irons had been sold, and Mr. J. F. Deatrick, Jr., who is contract agent for the company, is confident that there is still room for more irons among the 8000 inhabitants of which Defiance boasts.

A Convenient Lamp-Testing Box

For testing incandescent lamps without injury to the eyes of the exchange clerk at the delivery counter, the Manchester (N. H.) Traction, Light & Power Company uses the home-made device shown in the accompanying illustration. It consists of a wooden box 7.5 in. long and 6 in. square, with a 4-in. projection at one side carrying a



LAMP-TESTING BOX

small indicating wattmeter. One end of the box is open while the other end is fitted with a contact cup into which the lamp is pressed for testing the continuity of its filament. The top of the box is fitted with a glass window composed of an ordinary exposed and developed blank photographic negative. This serves to screen the observer's eyes from the glare of the filament but nevertheless transmits enough light from the latter to show the filament distinctly illuminated. On the side of the box toward the wattmeter a plain glass window is used so that the customer can see the lamp at its full brilliancy while he notes the reading of the instrument. As the customer sees such a test only occasionally, there is no likelihood of eye strain on his part, but for the clerk the large number of lamps tested daily at the delivery counter makes the translucent upper window a valuable feature.

Electric-Vehicle Development at Worcester, Mass.

An energetic electric-vehicle campaign is being conducted by the Worcester (Mass.) Electric Light Company, and within eighteen months the sale of forty-seven machines has been accomplished in the city, which was formerly known as one of the most conservative places of the East. The company has added an electric-vehicle sales engineer to its organization, has greatly enlarged its garaging facilities at the Faraday Street substation, and has eliminated nearly all of its horses, with an early prospect of performing all its transportation service by electric trucks. Every part of Worcester, which has numerous hills in its topographical make-up, is covered by the company's service, inspection and installation wagons, which also regularly "make" a 10 per cent grade 0.75 mile long outside the town of Leicester, a suburb now on the company's system.

Ten commercial electric vehicles are in the company's

own service, ranging in size from a 750-lb. wagon to a 3.5-ton truck, the latter being provided with a novelty in the shape of a gin-pole receptacle for use in erecting poles. Meter setting, motor and transformer deliveries and the handling of freight between the railroads and the company's storehouses are all cared for by electric vehicles. Among the recent large concerns adopting electric vehicles in Worcester are the Coes Wrench Company, the Barnard Sumner & Putnam Company, the Morgan Construction Company, the Bay State Coal Company and the Graton & Knight tannery. A recent newspaper advertisement of the Worcester company featured the possibilities of the electric vehicle in holiday-trade deliveries, and special efforts are being made to secure business along this line.

Large Lighting Units Attract Crowds

Formerly in auction salesrooms on crowded city thoroughfares the auctioneer was obliged to use his voice to attract the attention of the passing throng. In Pittsburgh, however, the electric-service company's solicitors have altered this condition by inducing the proprietors of one down-town auction room to install high-wattage tungsten lighting units near the entrance and over the head of the crier, where the lamps will attract the attention of the public and lead persons to enter. When doubt concerning the feasibility of the scheme was expressed by the owner the solicitor had only to call the prospective customer to his door and point out the difference between the number of persons waiting for cars and loitering in front of the well-lighted shops and those before the stores which were dark. A few minutes' observation in this way furnished convincing evidence of the value of electric lighting in attracting and holding crowds.

Electrical Equipment of a Modern Hotel

In the accompanying tabulation there is listed the electrical equipment of a modern hotel structure in the South, whose connected central-station load aggregates nearly 185 kw. The lighting installation comprises 2500 25-watt tungsten equivalents. Individual drive has been employed throughout, a total of 160 hp in motors being in use. Both electrical energy and steam-heating service are purchased from the central station, although the hotel management operates its own boilers for cooking and hot-water heating purposes. The annual energy consumption for lighting

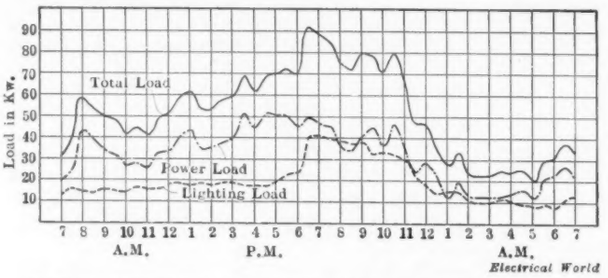
MOTOR EQUIPMENT IN MODERN HOTEL (20 MOTORS, 163.5 HP)

Number	Size, hp	Speed	Machinery Driven
1	6	898	Belted to exhaust fan.
1	0.25	....	Elevator signal system.
3	30	425–850	Direct-connected to three elevators.
1	2	1200	Direct-connected to air-washer.
2	5	1800	Direct-connected to house pumps.
2	2.5	550	Direct-connected to sump pumps.
1	7.5	825	Belted to vacuum pump.
1	3	1050	Direct-belted to ice crusher.
2	15	700	Silent chain, to ice machines.
1	0.5	2400	Direct-connected to circulating pump.
1	5	216	Belted to exhaust fan.
1	0.5	1800	Geared to potato peeler.
1	0.5	1500	Silver polisher.
1	3	1050	Belted to dish washer.
1	0.25	1700	Direct-connected to beer pump.

amounts to 118,500 kw-hr., and that for motor service to 183,000 kw-hr., with load-factors respectively 21 and 17 per cent.

For furnishing steam for cooking and hot-water heating, there are installed two 40-hp internally fired Scotch marine boilers. These operate at approximately 40 lb. pressure, supplying steam for soup kettles, boilers, hot plates, chafing dishes, coffee and tea urns and other similar cooking devices, and to the heaters used for supplying hot water to the various parts of the hotel.

Exhaust steam from the cooking apparatus and boiler-feed pump supplies such distilled water as is necessary for ice making. It is therefore rarely necessary to furnish live steam for this purpose.



HOURLY LIGHTING AND MOTOR LOAD OF HOTEL FOR JULY

Individual-motor drive is employed throughout, all motors being of the 220-volt direct-current type, with the exception of the 110-volt, 0.25-hp motors which operate the elevator signals and the beer pump. The table herewith shows the size of motor employed for each purpose, and the accompanying curve-sheet reveals the hourly demand of the lighting and motor circuits.

The Value of a Cooking Load

BY R. B. MATEER

Many plausible reasons are cited in support of the apathetic attitude generally maintained toward electric cooking and the electric range. To quote a few of the statements heard: "Electric cooking occasions a high demand and our system will not stand it." "The public is not prepared for electric cooking." "Look at the cost of rebuilding our system to accommodate such service." And from the combination gas-electric plant manager, "Why boost electricity when we also sell gas?" Such a list might be continued indefinitely, although each expression shows either a lack of initiative on the part of the management of the utility or a woeful want of knowledge of the practical operation of the modern electric range.

With the view of stimulating interest in electric cooking the accompanying table is presented, giving consumption and cost data gained from a year's practical experience in a household using electricity for lighting and cooking purposes and gas for water heating. Electricity for lighting was sold at 7 cents per kw-hr. and for cooking purposes at 3 cents per kw-hr., while the price of gas was 90 cents per 1000 cu. ft.

The characteristic results presented in the table afford some idea of the value of such combination service as supplied to the average home. They suggest also the possibilities obtainable were the electric range more generally pushed—not as an auxiliary but as an all-year-round appliance. The twelvemonth period covered is sufficient to demonstrate the value of a cooking and heating load as compared with the consumption of the average residence consumer for illuminating service only.

It will be noted that while only 287 kw-hr. were required for lighting, 2441 kw-hr. were consumed for cooking purposes. This cooking consumption occurred, furthermore, at an annual load-factor twice that of a purely lighting load. Again, the annual gross receipts were only $20.95 for the customer's lighting service, while for his cooking even at the 3-cent net rate $73.23 was assured. The amount actually collected was, however, $92.87, since the absence of an authorized heating rate necessitated the use of the "power" schedule with its high minimum of $6 per month based on

the connected heating load. The connected load for lighting was 1000 watts. That for heating was 750 and that for cooking 4400, a total of 5150 watts, but the maximum demand never exceeded 2225 watts.

Day circuits suggested the development of industrial load. Aggressive sales engineering secured revenues far in excess of the early expectations of the office managers

COST OF ONE YEAR'S DOMESTIC ELECTRIC COOKING AND LIGHTING, WITH WATER HEATED BY GAS

LIGHTING		COOKING		WATER HEATING	
Kw-hr.	Amount	Kw-hr.	Bill Rendered	Cu. Ft.	Amount
9	$0.63	.....	.....	1,100	$0.99
37	2.59	149	$6.40	4,800	4.32
37	2.59	289	8.67	6,200	5.58
45	3.15	390	11.70	10,400	9.34
35	2.45	414	12.42	6,300	5.62
27	1.89	331	9.93	5,000	4.50
26	1.75	325	9.75	6,400	5.76
24	1.47	195	7.00	4,000	3.60
48	1.25	88	7.00	4,100	3.69
15	1.05	118	7.00	3,500	3.15
15	1.12	86	7.00	3,600	3.24
11	1.00	55	6.00	2,100	1.89

of utilities. Judging the future by the past, will it be the insistent demands of aggressive citizens for service that is efficient and convenient, or will it be the awakening of public utilities to the investment already tied up in their residential circuits which, idle in daytime, may be made good revenue producers—that will bring about the wider development of cooking and heating service?

Central-Station Unit-Cost Accounting

The attention given to accounting methods by the N. E. L. A. and other central-station organizations, followed by the advent of the public commission with its compulsory rules, has awakened many central-station managers to the possibilities presented by good bookkeeping systems for the detection of "leaks" which drain the company's treasury. Many of the systems in use have merit and are producing good results. Among these the unit-cost system which has been instituted at the Muncie (Ind.) property of the American Gas & Electric Company gives promise of showing the relative operating characteristics of the plant equipment in a manner that will leave little doubt as to the value of each piece of apparatus as compared with its neighbor.

In the illustrations presented herewith each blank used in connection with this system is reproduced. Fig. 1 shows the daily time slip made out by each workman. At the end of each day one of these slips is filled out, the man stating in the blank space left for the purpose on which station unit or auxiliary he has been employed. The workman also fills in the time for each job and indicates the nature of his work. Any material used on the job is also included in his report. All time slips are then O. K.'d by the plant clerk, who has instructions to see that all blanks are properly filled.

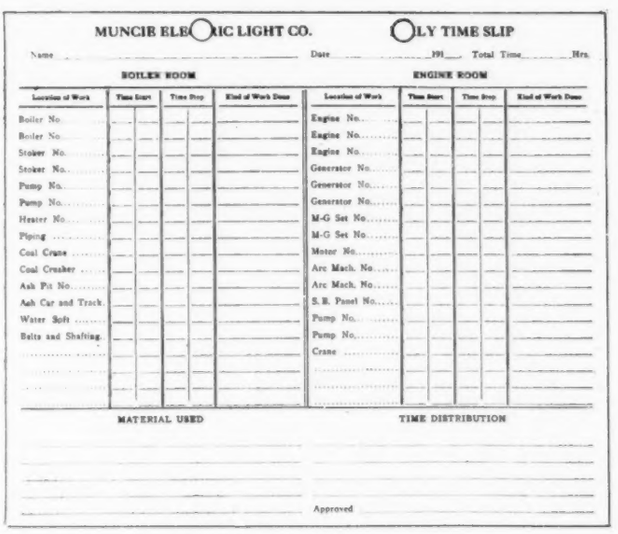


FIG. 1—WORKMAN'S TIME SLIP

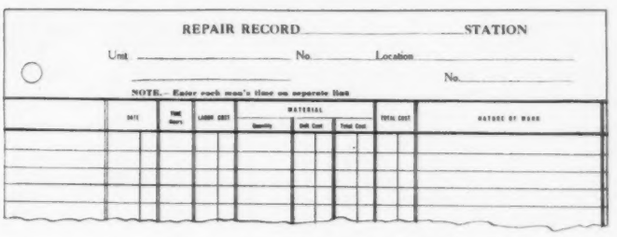


FIG. 2—STATION REPAIR RECORD

In the illustrations presented herewith each blank used in connection with this system is reproduced. Fig. 1 shows the daily time slip made out by each workman. At the end of each day one of these slips is filled out, the man stating in the blank space left for the purpose on which station unit or auxiliary he has been employed. The workman also fills in the time for each job and indicates the nature of his work. Any material used on the job is also included in his report. All time slips are then O. K.'d by the plant clerk, who has instructions to see that all blanks are properly filled.

At Muncie it has been found advantageous to keep the costs for the engine and generator as one unit, for it is sometimes hard for the men to tell whether their work has been done on the steam or the electrical end of the machine. To facilitate further the work of the men who make out the slips, each unit in the station has been stenciled with the number which corresponds to the one placed opposite its name in the monthly record (Figs. 4 and 6). The cooperation of the workmen has been sought in order that the column of the blank in Fig. 1 which is headed "Kind of Work Done" shall not be meaningless, and after they have had a few instructions from the plant clerk, who signs the completed blanks, little trouble is experienced in securing reliable information as to the nature of the work performed on any particular machine.

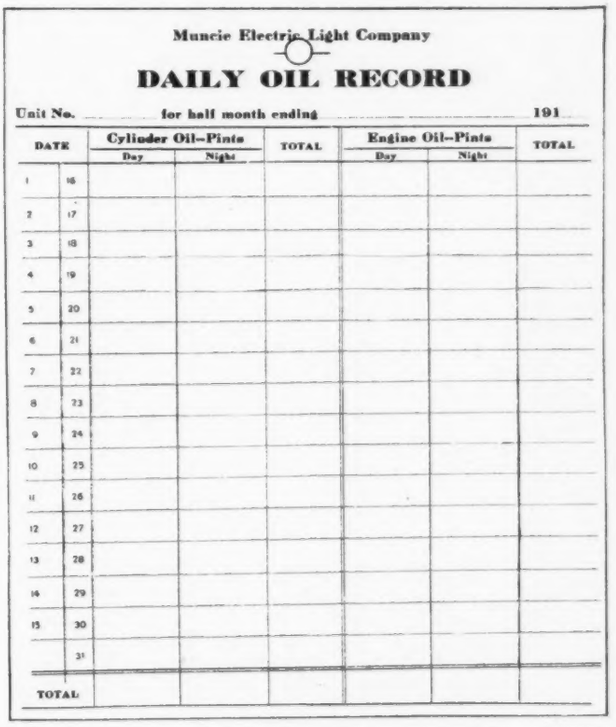


FIG. 3—RECORD FOR OIL USED PER UNIT

The so-called "daily oil record" shown in Fig. 3 is in

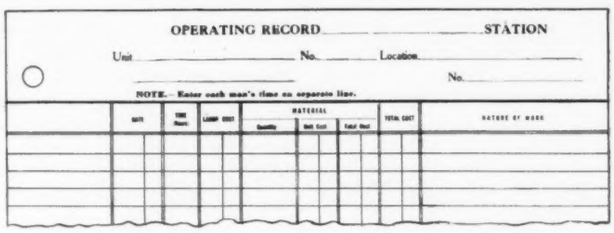
reality a semi-monthly record. The blank form is tacked upon a board near the unit to which it applies, and as the oil is used for the machine a record of each measure is marked on the slip. These blanks are collected at the end of each fortnight and used in connection with the portion of the daily time slip marked "material used" to make up the record of the machines.

Since the time slips are generally soiled and not in condition to be kept as records, the data they contain are transferred each day to the station-repair and station-operating records, the headings of which are reproduced in Figs. 2 and 5. Upon these forms the first step in the cost analysis is taken. The item of time and labor spent in plant operation is separated from that taken by repairs, and entered in the columns provided for that purpose. An operating and a repair sheet are kept for each unit in the plant. The time in operation and the time banked are noted on the sheet for each boiler.

At the end of the month a complete and compact record of the time spent in operation, material used for repairs, and time consumed in making repairs is afforded by these two sheets. These data are then once more transferred to sheets known as unit-cost records, shown in Figs. 4 and 6. Upon the boiler-room unit-cost record two lines are provided for each boiler and auxiliary in the station. On the first line are entered the time in hours which the boiler was in actual operation, together with the operating costs of material and labor and the repair costs for material and labor. A like entry is made in the second line for the time during which the boiler was banked. With this information on the blanks a simple division reduces all of the data to a common basis, that of material and labor cost per hour operated, from which any unit can be compared with any other on points of repair costs and operating costs.

Similar treatment of all the engine-room equipment brings out the cost of operating and repairing the individual units in that part of the station with a vividness which will certainly be conducive to good judgment in the future purchase of machines. On this record the various makes of machines stand out against each other on a common basis which reveals their faults and tells of their shortcomings. Not only does the record show the faults but it constructively points the way to the avoidance of similar future troubles. Monthly reports are totaled and preserved, forming a yearly record for the station units.

The maintenance of these records requires the time of one man for about one and a half hours each day throughout the month, excepting the time required for totaling. The collection and calculation require longer, and the time allowed for this work varies with the amount of repairs that has been made in the month. A separate set of books kept by the accounting department of the company carries the interest and depreciation charges on the equipment so that they are not included in these reports. As yet no attempt has been made to apply this scheme to the outdoor work of the company, although the system seems to be admirably adapted to that service.


OPERATING RECORD ..... STATION

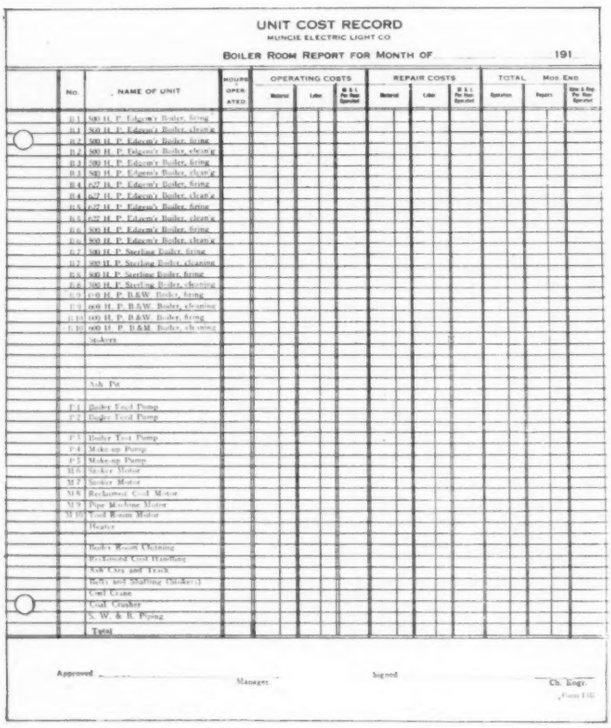
Unit ..... No. ..... Location .....

No. .....

NOTE.—Enter each man's time on separate line.

	Unit	Time Hours	Labor Cost	Material			Total Cost	Nature of Work
				Quantity	Unit Cost	Total Cost		

FIG. 5—STATION OPERATING RECORD


UNIT COST RECORD

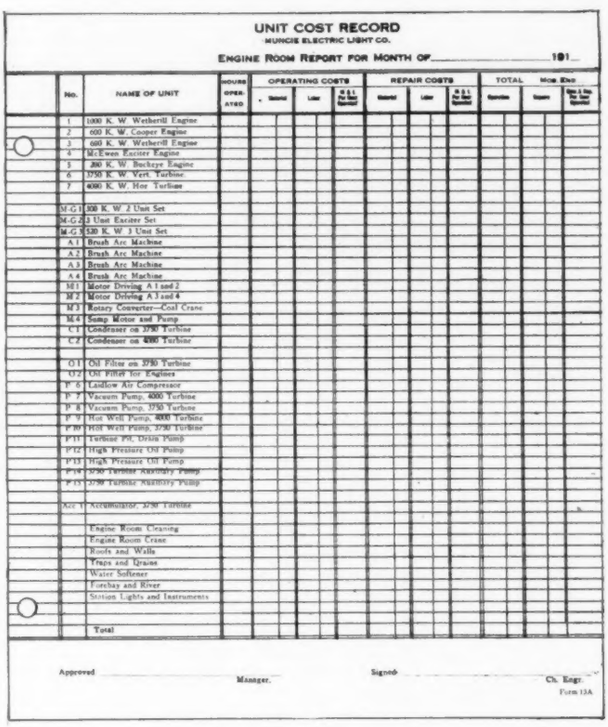
MUNCIE ELECTRIC LIGHT CO.

BOILER ROOM REPORT FOR MONTH OF 191

	No.	NAME OF UNIT	Hours Operated	Operating Costs			Repair Costs			Total	Mon. End	
				Material	Labor	Per Hour Operated	Material	Labor	Per Hour Operated	Operation	Repairs	Hrs. & Kw. Per Hour Operated
	B 1	500 H. P. Edgemr Boiler, firing										
	B 1	500 H. P. Edgemr Boiler, cleaning										
	B 2	500 H. P. Edgemr Boiler, firing										
	B 2	500 H. P. Edgemr Boiler, cleaning										
	B 3	500 H. P. Edgemr Boiler, firing										
	B 3	500 H. P. Edgemr Boiler, cleaning										
	B 4	627 H. P. Edgemr Boiler, firing										
	B 4	627 H. P. Edgemr Boiler, cleaning										
	B 5	627 H. P. Edgemr Boiler, firing										
	B 5	627 H. P. Edgemr Boiler, cleaning										
	B 6	300 H. P. Edgemr Boiler, cleaning										
	B 7	500 H. P. Sterling Boiler, firing										
	B 7	500 H. P. Sterling Boiler, cleaning										
	B 8	500 H. P. Sterling Boiler, firing										
	B 8	500 H. P. Sterling Boiler, cleaning										
	B 9	600 H. P. B&W. Boiler, firing										
	B 9	600 H. P. B&W. Boiler, cleaning										
	B 10	600 H. P. B&W. Boiler, firing										
	B 10	600 H. P. B&W. Boiler, cleaning										
		Stokers										
		Ash Pit										
	P 1	Boiler Feed Pump										
	P 2	Duplex Feed Pump										
	P 3	Boiler Feed Pump										
	P 4	Make-up Pump										
	P 5	Make-up Pump										
	M 6	Stoker Motor										
	M 7	Stoker Motor										
	M 8	Reclaimed Coal Motor										
	M 9	Pipe Machine Motor										
	M 10	Coal Room Motor										
		Heater										
		Boiler Room Cleaning										
		Reclaimed Coal Handling										
		Ash Can and Truck										
		Roof and Walking (Stokers)										
		Coal Crane										
		Coal Crusher										
		S. W. & R. Piping										
		Total										

Approved ..... Manager. Signed ..... Ch. Engr.

FIG. 4—UNIT COST RECORD FOR BOILER ROOM


UNIT COST RECORD

MUNCIE ELECTRIC LIGHT CO.

ENGINE ROOM REPORT FOR MONTH OF 191

	No.	NAME OF UNIT	Hours Operated	Operating Costs			Repair Costs			Total	Mon. End	
				Material	Labor	Per Hour Operated	Material	Labor	Per Hour Operated	Operation	Repairs	Hrs. & Kw. Per Hour Operated
	1	1000 K. W. Wetherill Engine										
	2	600 K. W. Cooper Engine										
	3	600 K. W. Wetherill Engine										
	4	McEwen Exciter Engine										
	5	300 K. W. Buckeye Engine										
	6	3750 K. W. Vert. Turbine										
	7	4000 K. W. Hor. Turbine										
	M-G 1	300 K. W. 2 Unit Set										
	M-G 2	3 Unit Exciter Set										
	M-G 3	520 K. W. 3 Unit Set										
	A 1	Brush Arc Machine										
	A 2	Brush Arc Machine										
	A 3	Brush Arc Machine										
	A 4	Brush Arc Machine										
	M 1	Motor Driving A 1 and 2										
	M 2	Motor Driving A 3 and 4										
	M 3	Rotary Converter—Coal Crane										
	M 4	Sump Motor and Pump										
	C 1	Condenser on 3750 Turbine										
	C 2	Condenser on 4000 Turbine										
	O 1	Oil Filter on 3750 Turbine										
	O 2	Oil Filter for Engines										
	P 6	Ludlow Air Compressor										
	P 7	Vacuum Pump, 4000 Turbine										
	P 8	Vacuum Pump, 3750 Turbine										
	P 9	Hot Well Pump, 4000 Turbine										
	P 10	Hot Well Pump, 3750 Turbine										
	P 11	Turbine Pit, Drain Pump										
	P 12	High Pressure Oil Pump										
	P 13	High Pressure Oil Pump										
	P 14	3750 Turbine Auxiliary Pump										
	P 15	3750 Turbine Auxiliary Pump										
	Acc 1	Accumulator, 3750 Turbine										
		Engine Room Cleaning										
		Engine Room Crane										
		Roofs and Walls										
		Traps and Drains										
		Water Softener										
		Forebay and River										
		Station Lights and Instruments										
		Total										

Approved ..... Manager. Signed ..... Ch. Engr.

Form 13A

FIG. 6—ENGINE-ROOM UNIT COST RECORD

Electric Ranges in Winnipeg

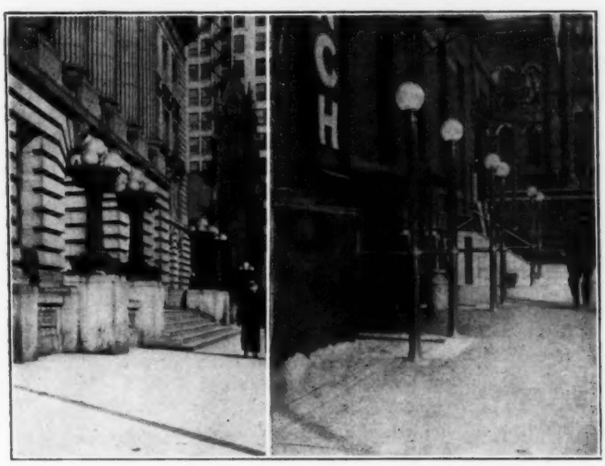
Owing to a typographical error, the number of electric ranges now in use in the city of Winnipeg, Man., was stated to be "more than 100" in a news item on "Electric Cooking Facts" printed in the *Electrical World* of Dec. 6 relating to an address by Mr. G. A. Hughes, of the Hughes Electric Heating Company. As a matter of fact there are approximately 1000 Hughes electric ranges installed in the city of Winnipeg.

Illumination and Wiring

Signs of Readiness for "White Way Lighting"

In a community of 100,000 inhabitants without an adequate uniform system of street lighting the individual ideas of the more progressive mechants and business men usually manifest themselves in privately owned installations of curb and building exterior illumination. The accompanying illustrations show how in one city of the class mentioned the lack of an efficient street-lighting system has led to the installation of widely varying types of fixtures ranging from very elaborate to extremely inexpensive patterns. The five-lamp ornamental standards shown in Fig. 1 are used about a public building. Fig. 2 shows a case in which the lamps are mounted on extensions of the brass handrail of a basement entrance. Each 10-in. globe contains a 60-watt lamp. Throughout the entire business section and even in front of churches and beautiful residences are to be found privately owned curb-lighting systems including every type of illuminant from single-lamp ornamental standards to elaborate arc-lamp posts.

With an active central-station company standing ready to furnish electrical energy for the lighting, with the entire



FIGS. 1 AND 2—LIGHTED FRONT OF PUBLIC BUILDING, AND INEXPENSIVE LIGHTING UNITS AT CITY SQUARE

population of the city seemingly favoring the movement, and with much smaller towns in the immediate vicinity successfully maintaining well-lighted streets, it looks as though here the time was ripe for the installation of some sort of modern street lighting. In places like the one described the City Council would do well to lend a more attentive ear to the advice offered by its friend the electric-service company.

Toledo's Electric Slogan Signs

The Toledo (Ohio) Railways & Light Company has presented to the city of Toledo one of the largest and most elaborate municipal slogan signs ever constructed or erected. The display, which was built by the Valentine Electric Sign Company, Atlantic City, N. J., measures 58 ft. high and 78 ft. long.

The first picture to appear shows an engine, tender and train of cars. Presently the train is seen to start, smoke comes from the stack in short puffs, and sparks shoot from under the wheels as they revolve. As the cars gain speed the track recedes and the smoke stretches out over the entire length of the train. Meanwhile the moving parts of the engine are working true to life, and the whole picture gives an accurate representation of a train going at full speed. The train picture then disappears and a huge freight steamer, like those used on the Great Lakes, is seen plowing through the water, throwing up spray at its bow, as shown in Fig. 1. Its flags are waving, smoke comes from its huge stack, and waves strike against its sides. The idea in showing the boat and train, it is explained, was to emphasize Toledo's importance as a center

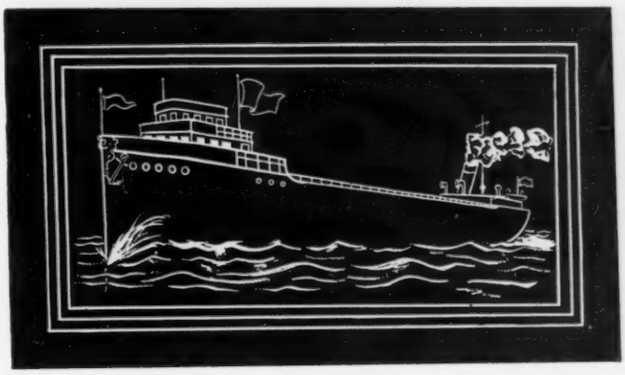


FIG. 1—LAKE STEAMER DEPICTED ON TOLEDO'S NEW SLOGAN SIGN

of transportation by both land and water, for the city's position at the head of Lake Erie and at the point of debouchure of the Maumee River with its system of cross-state canals has given Toledo a location of great strategic value in the country's inland commerce.

Finally, as the boat fades away the city's slogan, "You Will Do Better in Toledo," is flashed on in 18-ft. letters, while around the legend, revolving in different directions, appears a border of varicolored light. Three rows of lamps make up the letters—two rows being white and one red, so that the resultant is a pink color.

More than 7000 10-watt tungsten lamps were utilized to light this big sign, which complete weighs about 24 tons. It was erected on the roof of the Valentine Building, in which the Toledo city offices are located. The first exhibition of the sign was made a civic event. The Toledo Railways & Light Company will maintain the sign, the city providing only the locaton.

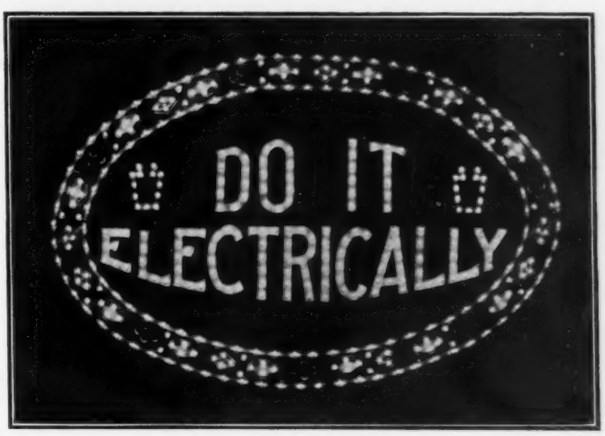
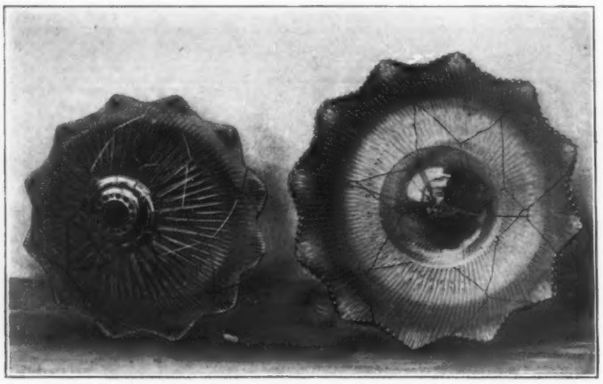


FIG. 2—SIGN ERECTED BY ELECTRICAL DEVELOPMENT SOCIETY

Another striking and artistic electric slogan display already in operation in Toledo is the "Do It Electrically" sign (Fig. 2), which the Society for Electrical Development recently erected in a prominent roof-top position. There are over 500 tungsten lamps in this sign, and the words of the motto are surrounded with a Persian jewel border in eight colors.

Protection from Falling Lamps and Reflectors

The use of wire netting to prevent injury from falling lamp shades and reflectors is not a new idea, but such protection is being carried out and expanded in the Westinghouse factories at East Pittsburgh, Pa., in an interesting and instructive manner. The accompanying illustrations



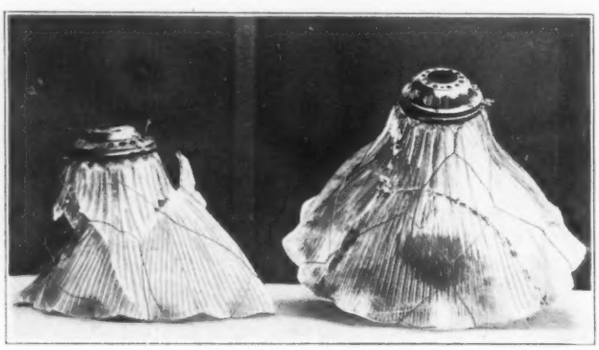
FIGS. 1 AND 2—METHOD OF FASTENING PROTECTIVE NETTING SHOWING COILED-WIRE CRADLE FOR LAMP TIP

show the application of the idea to glass reflectors for incandescent electric lamps.

As the glass shades come from the reflector manufacturer they are taken to the lamp and reflector supply room and there fitted with protective wire screens. Two girls are regularly employed to put the 2-in.-mesh netting over the shades and wire it to the brass cap at the top of the reflector. The netting fits the shades snugly both inside and out and is scarcely noticeable at a distance.

High-wattage lamps such as are used in these 12-in. and 16-in. reflectors also present a hazard by sometimes falling from their sockets when the plaster compound holding the glass bulb to the brass socket softens, transferring all mechanical strain to the leading-in wires. To anticipate accidents from this source a small double-coil spring like that shown in Fig. 2 is hooked to the netting and forms a cradle for the tip of the lamp bulb.

Figs. 3 and 4 show two reflectors which were broken into several pieces and yet were held aloft by the wire mesh. One of these reflectors, that shown in Fig. 3, hung just above a steam boiler which exploded, shattering the shade as seen, although the netting prevented in-

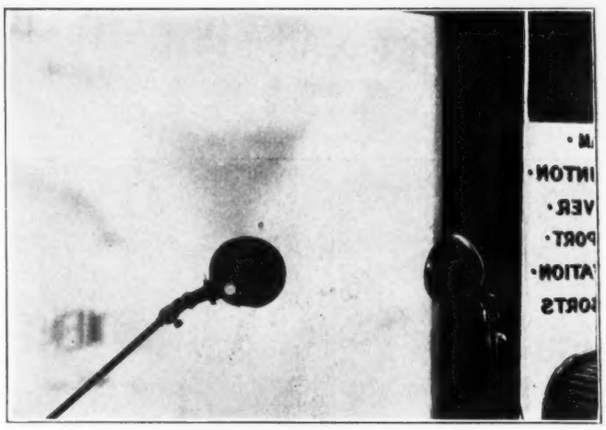


FIGS. 3 AND 4—WIRE NETTING HOLDING THE BROKEN SHADES IN PLACE

juries from flying glass. The reflector in Fig. 4 was found broken by an inspector while making lamp renewals. It is estimated that the large piece of glass at the front weighs about 2 lb. Such a weight falling from the height of the usual ceiling might have inflicted an ugly wound.

Effective Method of Emphasizing Window Lettering

To increase the effectiveness of the sign painted on the window of a Boston office, providing a transparency effect when viewed from the street, two adjustable lamps are arranged nightly as shown in the illustration. The window, 4 ft. 6 in. square, carries an advertisement and trade-mark which are easily seen during the day, although at a height one story above the street. After dark when the office is lighted this lettering becomes somewhat obscured unless a contrast is provided behind it. The problem was solved, however, by pulling down a white roller curtain and turning on two 60-watt lamps in the reflectors shown. These reflectors are mounted on the ends of ¾-in. tubing, forming in each case an adjustable arm 32 in. long. The use of a combined ball-and-socket and pin joint at the arm support provides maximum flexibility. When the lamps are thrown into service the transparency effect from the street below is almost as sharp as if the window lettering were



USE OF PORTABLE LAMPS TO LIGHT WINDOW SIGN

projected on the screen in a darkened auditorium, and the contrast of this window with others in the same block is so striking as to compel attention from the street level and make the words it bears as legible as in the daytime.

Recent Telephone Patents

Telephone Lock

When a telephone is left in an exposed condition, especially when on the message rate system, it sometimes becomes advisable to lock it against use by non-authorized persons. A lock for this purpose is the subject of a patent granted jointly to Messrs C. D. Rhinhardt and L. P. Saponoff, of New York City. The lock consists of a hinged hasp arranged to fit the upright of the usual desk stand and provided with dependent lugs, which will embrace the hook-switch lever in a manner to hold it depressed. The hasp carries a lock with key.

Subscribers' Station Apparatus

In an endeavor to increase the efficiency of transmitters, Mr. G. A. Nussbaum, of London, England, has invented a transmitter in which the rear face of the diaphragm carries one of the electrodes. The microphone button is held near this electrode, the wall of the latter being formed by means of a tubular ring of resilient material. This effects a close but flexible contact.

An antiseptic device that is patented by Mr. K. Tichy, of Chicago, utilizes a protective sheet of paper. It consists of a sheet metal holder adapted to the clamp beneath the shoulder of the ordinary mouthpiece. A roll of paper is carried at one end of the holder with a winding spool at the

other. Fresh paper is drawn across the mouthpiece as desired.

A railway dispatch selective system has been patented by Mr. A. C. Reid, of Genoa, Ill., in which signaling of the desired line is accomplished by prolonging the current impulse at one particular angular displacement of the apparatus. This prolonged impulse is obtained by attaching a long tooth on the selector wheel which prevents breaking of the circuit for this particular station at the desired angle. This patent is assigned to the Hall Switching & Signal Company.

In the illustration is shown an automatic switch, patented by Mr. G. E. Mueller, of La Grange, Ill. The contact banks are arranged inside of a surface curved as indicated by the dotted lines. It will be seen that through the combined use of a vertical and horizontal axis the contact wipers may be swung to any desired contacts. The motion of the wipers

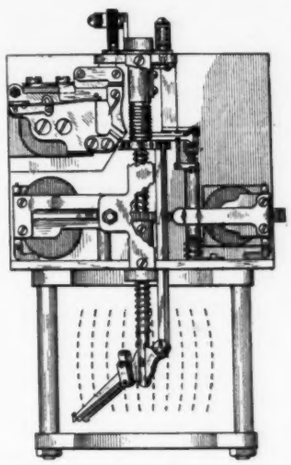


FIG. 9—GENERAL VIEW OF GENERATING STATION

about the horizontal axis is effected through a sliding sleeve mounted upon the vertical shaft. This patent has been assigned to the Kellogg Switchboard & Supply Company.

Letters to the Editors

Combined Synchronous and Induction Motor Loads

To the Editors of the Electrical World:

SIRS:—Referring to the editorial comment in the *Electrical World* of Nov. 22 on Mr. H. L. Wallau's article entitled "Combined Synchronous and Induction Motor Loads," permit me to suggest that the "express-company-delivery" example used will cause many of your readers to question their present understanding of the subject.

It is well known that there is required less prime-mover energy to carry a given kva load at low power-factor than at high power-factor; but in the example chosen, as much energy in the shape of oats, wages, maintenance, etc., would be necessary with fifty of the wagons delivering packages to the villages and the other fifty transferring in the town as when the entire 100 wagons were delivering in the villages. In other words, seemingly the same energy would be required for a 100-kva load at 50 per cent power-factor as at 100 per cent power-factor. The facts are, as well known, that with a given kva electrical load the energy costs will fall off as the power-factor decreases, although not directly in proportion.

Cincinnati, Ohio. W. S. CULVER.

[It is impossible to find any mechanical or economic simile for electrical phenomena that will accurately represent all of the factors involved. We fully agree with Mr. Culver that our simile for an express system does not correctly indicate the magnitude of the disadvantages incident to operating an electrical system at low power-factor. However, it serves the desired purpose of showing that the term "wattless power" is not only inaccurate but actually misleading.—EDS.]

Apportionment of Off-Peak Load Costs

To the Editors of the Electrical World:

SIRS:—It seems that the problem of just and equitable rates for electrical energy is about as far from a satisfactory solution as ever. This fact is disclosed by the letter in your issue of Nov. 22 in which Mr. S. M. Kennedy states that "the most unprofitable class of service is that supplied to the small consumers at the maximum rates." This argument has been stated and re-stated many times. The main reason for this contention undoubtedly lies in the common assumption that nearly all costs should be charged to the peak-load customers; that is, mainly to the users of electrical energy for lighting. The further ground for this contention is the assumption that the off-peak loads belong to the company, or, as stated by Mr. Ralph D. Mershon in his discussion of a paper on "Hydroelectric Plants" by Mr. H. L. Doherty, "it is fair that the supplying company should have the full advantage of non-coincidence of peaks, that it should not share this advantage with the consumer."

If that assumption be tenable, then the first statement by Mr. Kennedy may in some cases be conceded. The just and equitable distribution of costs between different classes of consumers is the crux of the whole matter. If the user of electrical energy for lighting pays all the costs, evidently the income from motor service is all profit. When, however, the costs are apportioned even approximately as they should be, then the whole matter assumes a different aspect, as disclosed by the following, taken from the records in the case of the Madison Gas & Electric Company (7 Wisconsin R. R. Com., R. 162): "If revenues and costs of production, as computed in Table VII, are compared, the greatest discrepancy is noted in *incandescent lighting*. Total costs here aggregate $130,783.90 as against revenue of $169,657.64, . . . and in *power business*, both railway and commercial, a cost of $49,199.73 as against a revenue of $49,283.25." The italics are mine. This shows a net profit of $38,873.74 on incandescent lighting and $83.50 on energy sold for motor service. The profit from incandescent lighting is approximately 30 per cent of the costs, while the profit derived from motor service is less than 0.2 per cent. Undoubtedly this is not an unusual case. The fact that the daily peak of the street-railway company coincides with the lighting peak in the winter seems to indicate that if costs were equitably apportioned it would be shown that the net profit of $83.52 would be changed to a net loss.

The fallacy in the usual method of apportioning costs is found in the assumption that the off-peak load belongs to the public utility company. Underlying this there is another assumption, namely, that the *public service* company is a *private* concern. Sooner or later it will be recognized that, as stated by Mr. Max Thelen, a member of the California Railroad Commission, "the fundamental relationship existing between the public and its public utilities is that of principal and agent. Out of this relationship logically should grow the proper basis for determining the rates which a public utility is entitled to charge." Under this principle the off-peak load, or the advantage due to a non-coincidence of peaks, does not belong wholly to the public utility.

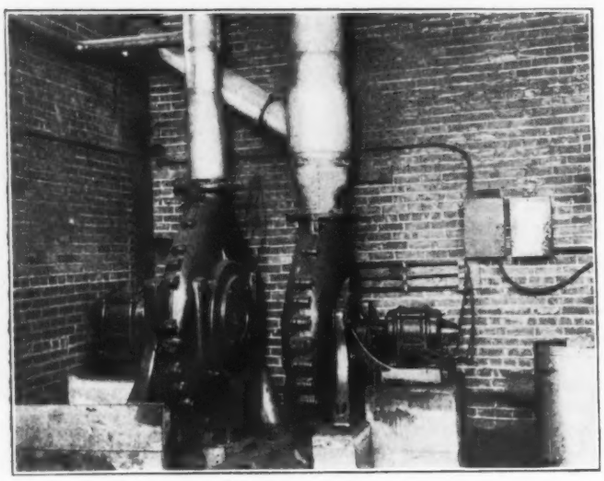
Madison, Wis. C. M. JANSKY.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Motor-Driven Compressor for Special Cupola Furnace

To separate brass and copper from slag skimmed from ladles the Michigan Smelting & Refining Company, Detroit,

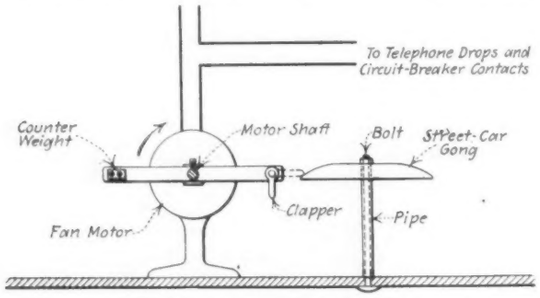


MOTOR-DRIVEN COMPRESSORS IN SMELTING AND REFINING WORKS

Mich., is using a special cupola furnace, air for which is furnished by a motor-driven centrifugal compressor. A pressure of 1.5 lb. is required to prevent the slag from packing when molten, and as only 0.75 lb. pressure is needed in the reverberatory and crucible furnaces two separate compressors are installed to furnish the respective pressures. The two sets are shown in the accompanying illustration. The high-pressure unit is rated at 3300 cu. ft. per minute, while the low-pressure compressor is designed to deliver 2100 cu. ft. per minute.

Motor-Driven Alarm Bell

The accompanying sketch shows a simple motor-driven power-house alarm gong which is connected with not only



POWER-STATION ALARM GONG

the telephone but also with all of the important feeder circuits of the Paducah Light & Power Company, Paducah, Ky. The accompanying sketch is quite self-explanatory. Fixed to the fan-motor shaft is a balanced cross-bar, one end of which is fitted with a loose-swinging clapper. When the motor and arm are in rapid rotation, the clapper swings out under centrifugal force and strikes the street-car gong in the dotted position shown. Before securing the motor base to the stand, Mr. Joseph Jacobs, of the Paducah Light & Power Company, suggests that the motor be first started and brought closer and closer to the gong until an adjustment is reached where the greatest possible volume of sound is produced. The gong in the Paducah station can be heard three blocks away. The gong motor is energized through back contacts on the drops for the telephone and through the relays for the circuit-breakers.

A Single-Phase Two-Phase Confusion

The accompanying diagram indicates conventionally a system of incidental connections that caused operators and inspectors a lot of trouble before the source of irregularity was found. The two-phase induction motor was located some distance away from the two-phase alternator which was installed in a power station that included a complicated system of switches for reinforcing either single-phase or two-phase feeders, leading to motor and lamp mains of outlying buildings. No attempt has been made to reproduce the actual connections that caused the trouble, because no one knows what they were. The connections of switch *A* do, however, indicate the net results of the unusual combination that obtained occasionally to keep everybody guessing. Here it may be seen that when switch *A* is up the motor gets two-phase currents from the alternator. When the switch is down, however, both of the motor coils are subjected to currents from the same phase of the alternator. The result of this condition, which was in evidence only occasionally, was that sometimes the motor would start and sometimes it would not, and on several occasions when the inspector was summoned by the time he had got there the motor was all right again, because manipulations of the switches in the power station had restored the two-phase conditions necessary for starting. As numerous tests had proved the motor itself to be perfectly regular in the matters of resistance, impedance, speed and torque, and as the inspector had about exhausted the field of investigation of conditions likely to prevail, he started in to investigate some of the conditions not likely to prevail. Thus it happened that he tested the phase re-

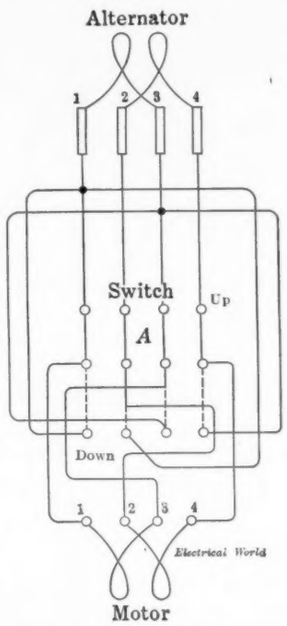


DIAGRAM OF CONNECTIONS CAUSING SINGLE-PHASE TWO-PHASE CONFUSION

lations of the currents supplied to the motor at one of the times that it refused to do anything but hum and blow fuses. This test revealed that at such times as the motor failed to start the two currents supplied to it were from the same phase of the two-phase alternator. An independent line run to the motor from the station busbars fixed things, and they have stayed fixed.

Pay-Envelope Safety Suggestions

For inculcating safety ideas the pay envelope offers a medium not easily overlooked by the recipient. Repeated suggestions to "be careful" insisted on from week to week in different words cannot fail in their mission of education. Realizing this, the United Gas Improvement Company, of Philadelphia, Pa., in line with its other endeavors toward accident prevention, prints rubber-stamp safety suggestions on its pay envelopes, thus emphasizing the safety idea at a most opportune time. Among the admonitions given in this way are "Safety always," "Every effort toward safety helps," "Are you guarding the danger points?" "Carelessness is dangerous," "Safety preserves life and happiness," and "Safety first, last and all the time."

Rotor Resistance and Torque

The maximum torque of an induction motor is independent of the resistance of its rotor, but by changing the resistance of the rotor the maximum torque can be obtained with any desired percentage of synchronous speed. On rotors of the squirrel-cage type the resistance is governed by the dimensions and material of the rotor bars, and these properties cannot be varied during operation. On rotors of the internal rotating resistance type and of the slip-ring type the effective resistance of the rotor is variable by means of the variable resistor in series with it. On this type of motor the maximum torque can be disposed best to suit existing conditions. Some motors are on duty that require great torque for starting a heavy connected load, but once the load is started not so much torque may be required. Other motors need but little torque at starting because they are started comparatively free and the load worked on after they are up to speed. In the first case a rotor of high resistance would be required; in the second case a rotor of comparatively low resistance; in both cases, assuming the same machine to be involved, the total maximum torque obtainable would be the same.

To illustrate the practical application of these facts: (1) In one case in mind a little three-phase squirrel-cage induction motor operating from a single-phase line was started by means of a resistor-inductor, phase-splitting starting box. When the motor was cold it could not start its load, a shoe-buffing machine, except when assisted by pulling on the belt. After several starts at close intervals or after half an hour of normal operation the motor would start its load promptly and without assistance, because heating of the rotor would increase its resistance, thereby transferring the rotor's maximum torque back toward the point of zero speed. (2) In another case exception was taken to the slow speed of a slip-ring induction motor that operated a traction conveyor used to haul hot car wheels from the molding floors to the pit in a wheel foundry. Inspection showed the motor and the external resistor and controller for operating to be regular in every respect. The line voltage was above normal, the track on which the conveyor trucks traveled was clean, and the trucks were well lubricated and free from interferences. All gears and bearings on the pulling machine were in good shape, and with the traction cable removed the speed of the motor was practically synchronous. By a process of elimination the more common sources of irregularity were dismissed and the cause of slow speed proved to be the long distance between the motor and the controller and rheostat to which it was connected. The leads used to short-circuit the rheostat on the last controller position were so long that what should have been a short-circuit had sufficient resistance to impair the running torque and appreciably affect the maximum speed. On moving the rheostat and controller about 250 ft. nearer to the motor the desired maximum speed was obtained. Had this been impracticable it would have been necessary greatly to increase the cross-section of the wires that connected the motor, controller and rheostat together.

Storage of Oil Fuel

By R. T. STROHM

The method of storing the supply of oil for an oil-burning boiler plant is a matter to which careful consideration should be given. The objects that should be kept in mind while planning the storage system are safety and capacity.

For the average boiler plant of small or medium size the oil supply is usually stored in cylindrical steel tanks like that shown in Fig. 1. The tank is built up of steel plates, has dished ends and is usually buried in the ground at such a level that its top is below the level of the tips of the burners. The object of this arrangement is to prevent flooding of the furnaces or of the boiler room with oil in case a burner valve is accidentally left open; for with the tanks below the level of the burners the oil will flow back by

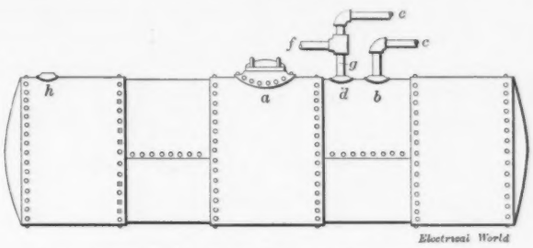


FIG. 1—OIL-STORAGE TANK WITH CONNECTIONS

gravity if a valve is left open at the burners. As the tank is usually covered with earth, it should have a good coat of tar or some protective paint to enable it to resist the effects of dampness.

The common sizes of oil tanks for boiler installations are 8 ft. in diameter by 28 ft. long and 9 ft. in diameter by 33 ft. long. The former has a capacity of about 10,500 U. S. gallons and the latter a capacity of approximately 15,500 U. S. gallons. In either case, a good quality of steel plate 5/16 in. thick should be used, and the heads should be made of 3/8-in. plate.

There should be no openings in the bottom, sides or ends of the storage tank. Such openings as are required should be at the top. The largest opening required is that for the manhole, as at *a*, Fig. 1, and this should be fitted with a screw-down cover. There must be a flange *b* for connecting the suction pipe *c* that leads to the pump, and another *d* for the overflow pipe *e*, leading back from the standpipe or from the pressure pumps. The filling pipe *f*, by which the oil is run into the tank from the tank car, may be attached by a T to the overflow pipe and both connected with the tank through the nipple *g* and the flange *d*. Again, there must be a flange *h* to which a ventilating pipe can be connected. If the oil around the end of the suction pipe must be heated, so that it will flow readily to the pumps, then it will be necessary to add two more flanges for the pipes that convey the live steam and carry off the condensation.

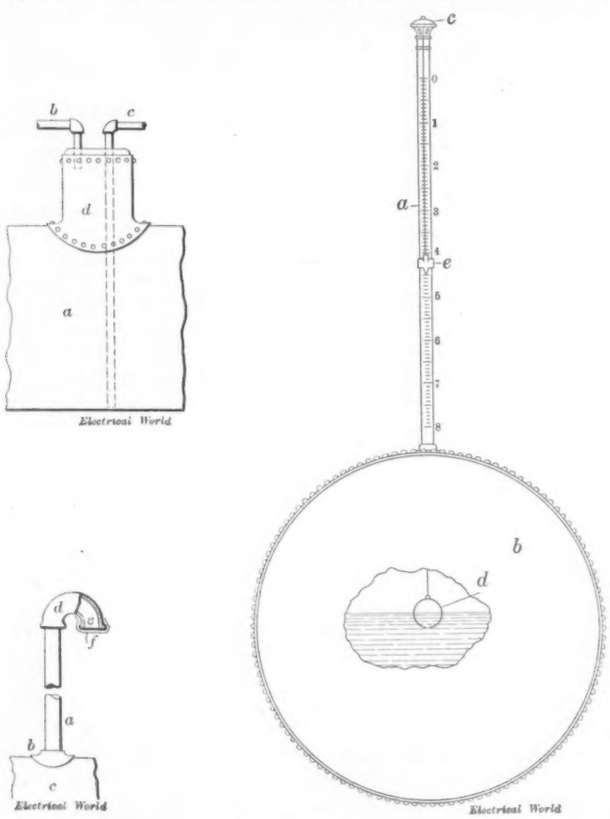
The work of designing and constructing the tank should

be put in the hands of a manufacturer familiar with the requirements of steam-boiler construction, because the tank must be absolutely oil-tight. All petroleum oils are very penetrative in their character, and if there is any suspicion of looseness at the seams or around the rivets, the oil will find its way through. For this reason the rivet holes should be drilled, or else punched and reamed, and the seams should be thoroughly calked.

The capacity of the tank or tanks installed depends on the size of the plant and the frequency with which shipments of fuel may be delivered. If the plant lies fairly close to the oil fields, so that there is little delay in obtaining fresh shipments, it is unnecessary to carry a large supply in storage, and the tank or tanks may be made of such size as to hold oil enough to run the plant for a week. A tank 9 ft. in diameter and 33 ft. in length will contain one week's supply of oil for a plant of 500 boiler-hp operating ten hours a day at an average efficiency of 75 per cent.

If the plant is so located that shipments of oil may be delayed and cannot be relied on to arrive with regularity, it may be necessary to provide storage capacity for a month or more of continuous working, so as to make reasonable provision against the possibility of a complete shut-down.

The location of the storage tanks must be carefully considered, in order to conform to the requirements of the underwriters. For example, if the tank is placed above the ground level, it must be situated at least 200 ft. from inflammable property, so as to minimize the danger to that property in case the oil should catch fire. In the case of a plant located in a town or a city, this requirement would



FIGS. 2, 3 AND 4—ARRANGEMENT FOR EMPTYING CAR; SIMPLE FORM OF VENT PIPE; VENT PIPE AND TELLTALE

be hard to meet, owing either to the difficulty of finding available storage space or to the high cost of such space. On this account, storage tanks are usually placed underground. The requirements for an underground tank are that it must be at least 30 ft. from the nearest building and that it must be at least 2 ft. below the surface of the ground. In either form of installation the top of the tank must be below the level of the lowest pipe in the oil system, so that the plant cannot be flooded with oil.

For ease in filling, the storage tank should be near the railway siding on which the tank cars are run, and at a lower level, so that the oil may be run from the tank cars into the storage tank by gravity. This is the least expensive method of making the transfer. If the tank is not at a low

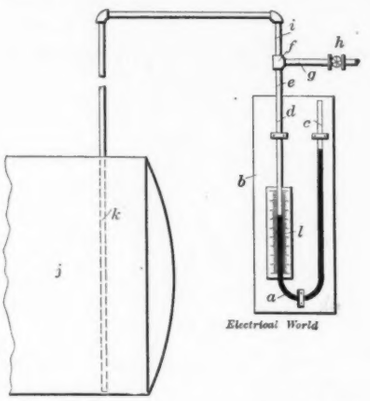


FIG. 5—INDICATOR FOR OIL-STORAGE TANK

enough level to allow this method of filling to be used, the oil may be pumped out of the tank car into the tank, the suction pipe extending into the tank car and the discharge pipe being connected to the filling pipe of the storage tank.

Air pressure has been used as a substitute for pumping in some instances. The method by which it is employed is shown in Fig. 2, in which *a* represents the central part of the tank car. Two pipes *b* and *c* are connected to the dome *d*. The former is short and extends only a little distance into the dome. The other is long enough to reach to the bottom of the tank car and is connected to the filling pipe of the storage tank. All other outlets from the tank car are kept closed, and compressed air is admitted through the pipe *b*. The pressure of the air on the surface of the oil forces the oil up the pipe *c* and over into the storage tank.

It is stated that tank cars are tested under a pressure of 40 lb. per sq. in., but it is wise to use a compressed-air pressure of not more than 10 lb. per sq. in. A pressure of 10 lb. per sq. in. will balance an oil column approximately 24 ft. high, and it is doubtful whether the storage tank will ever exceed this height above the bottom of the tank car. The use of air pressure in this way is strongly condemned by some of the tank-car lines, and placards are attached to their cars warning users not to employ this method of emptying the cars.

Of course, compressed air is not available in a great many plants, as most of them use steam to atomize the oil. Steam pressure would force the oil out of the tank car just as well as air pressure, but the steam would condense and the water would settle to the bottom of the car and be forced out with the oil into the storage tank. As a result, steam is not used in this way.

While the storage tank is being filled with oil, the air originally contained in it is being displaced and driven out. To afford a means of escape for this air, a vent pipe is attached to one of the flanges at the top of the tank. This pipe serves another purpose, also, in that it allows the escape of gases rising from the oil. At the ordinary temperatures at which the oil is kept in the storage tanks, there is a certain amount of evaporation, the lighter and more volatile constituents changing to the gaseous form. The vent pipe, open to the outer air, affords easy escape for these gases and prevents the rise of pressure that would result if there were no outlet.

One of the simplest forms of vent pipe is shown in Fig. 3. It consists of a straight piece of pipe *a* about 3 ft. long, screwed into the flange *b* on top of the tank *c*. On its

upper end a return bend *d* is screwed, and over the opening *e*, which faces downward, a piece of wire gauze *f* is firmly bound. The downward curve of the return bend prevents any sparks from dropping into the vent pipe and igniting the gases arising from the oil, and the gauze prevents the flame from traveling back into the tank even if the gases are ignited at the opening *e*, outside the gauze.

Another form of vent pipe is shown in Fig. 4. It is a straight pipe *a*, somewhat longer than the diameter of the storage tank *b*, and is screwed into a flange at the top of the tank. At the top of the pipe is a cap *c* that has a number of openings in its under side. These openings allow the escape of air or gases from the tank and are covered with wire gauze to prevent a flare-back.

This particular form of vent pipe serves also as a telltale, that is, as an indicator to show the amount of oil in the tank at any specified time. Inside the cap *c* is a small pulley over which a wire passes. To one end of the wire is attached a float *d*, which falls or rises as the level of the oil in the tank changes. To the other end of the wire is attached a pointer *e*, and as the float falls or rises the pointer rises or falls an equal distance. On the vent pipe, just behind the pointer, a scale is marked, divided into feet and inches, the total length of the scale being equal to the inside diameter of the tank. The position of the pointer then indicates the depth of oil in the tank, in feet and inches. A table may easily be compiled showing the amount of oil in the tank at each inch of depth. Then, when the depth of oil is noted on the telltale, the amount of oil corresponding to that depth can quickly be found.

If compressed air is used as the atomizing agent in the plant, or is otherwise available, the form of indicator illustrated in Fig. 5 may be used. A glass tube *a* of U-shape is fastened to a board *b* that in turn is fastened to the wall or to some other convenient support. The tube is partly filled with mercury and the leg *c* is left open to the air. The other leg *d* is connected by a rubber tube to a pipe *e* that is screwed into the T-fitting *f*. Two other pipes are connected to the T. That at *g* leads to the compressed-air system and is fitted with a valve *h*. The other pipe *i* leads to the bottom of the oil-storage tank *j*. All of this piping may be of ⅛-in. wrought-iron pipe.

The action of the indicator is simple. The valve *h* is opened very slightly, so that air leaks past it into the leg *d* of the U-tube and into the pipe *i*. As the air continues to flow into the pipe *i*, the pressure therein grows greater, and this pressure acts on the mercury and on the oil with equal intensity. The result is that the oil in the pipe *k* is forced down until finally it is all driven out at the lower end, and air escapes into the tank. At the same time the increasing pressure of the air forces the mercury down in the leg *d* of the tube and up in the leg *c*. Behind the leg *d* is a graduated scale *l*, and the position of the top of the mercury column in the leg *d* is read on the scale.

The deeper the oil in the storage tank, the greater is the pressure required to force the oil down out of the pipe *k*, and consequently the lower will the mercury be forced in the leg *d*. Every reading of the mercury level on the scale *l* therefore corresponds to a certain depth of oil in the storage tank, and hence to a certain definite quantity of oil. A table is compiled showing the amount of oil in the tank corresponding to each division on the scale. By comparing the reading at any time with the table the corresponding quantity of oil can be found. The accuracy of this device is based on the assumption that practically the same grade of oil is used continuously. If the oil varies in specific gravity from time to time, the scale will not correctly indicate the amount of oil in the tank.

With proper care there is little danger that the oil in the storage tank will catch fire; however, in some installations a steam pipe is connected to the top of the storage tank, so that live steam may be run direct from the boiler into the tank to smother any fire that may start.

Operating Results with an American Locomobile

Tests of an American-built 175-hp locomobile unit which produced a kilowatt-hour on 16.35 lb. of steam and 1.94 lb. of coal were described by Mr. George S. Cooper before the recent meeting of the Ohio Society of Mechanical, Electric and Steam Engineers.

The set used in these tests was a "Buckeye-mobile" built by the Buckeye Engine Company of Salem, Ohio, as described in these columns Aug. 16 and Oct. 4. Since last January it has been employed to drive a 125-kw direct-current generator, and it is in daily operation, handling a shop load consisting of cranes, machine-tool motors and lamps. The load on the machine varies from 60 kw to 160 kw. Daily records of coal consumption and electrical output show an average economy, with this varying load, of 2.4 lb. of coal fired for each kilowatt-hour at the switchboard. The fuel used is Ohio bituminous coal containing 40 per cent volatile matter and about 14,000 lb.-Fahr. heat units per lb. Better results are obtained with lower volatile coal.

Carefully conducted tests have been run from time to time to determine the efficiency of the set with various grades of coal and with modifications of the furnace and grates. The accompanying figures, Table I, give the

TABLE I—RESULTS OF TESTS ON 175-HP BUCKEYE-MOBILE SET

	A	B	C
Load, per cent	95.	114.	136.
Indicated horse-power	166	199	237
Kilowatts	99.4	121.5	146.8
R.p.m.	206	209	208
Steam pressure, lb	209	208	207
Saturation temperature, deg. Fahr.	391	391	390
Steam temperature at throttle, deg. Fahr.	638	673	668
Initial superheat, deg. Fahr.	247	282	278
High-pressure exhaust temperature, deg. Fahr.	313	353	387
Receiver pressure, lb	13	18	27
Low-pressure inlet temperature, deg. Fahr.	413	432	457
Low-pressure superheat, deg. Fahr.	169	178	188
Low-pressure exhaust temperature, deg. Fahr.	146	150	162
Feed-water temperature, deg. Fahr.	131	132	138
Vacuum (referred to 30 in. barometer), in.	25.6	24.3	24.3
Temperature gases base of stack, deg. Fahr.	501	558	578
Total steam per hour, lb	1626	1970	2420
Steam per ihp-hr., lb	9.8	9.9	10.2
Steam per kw-hr., lb	16.35	16.3	16.5
Total coal fired per hour, lb	192	238	283
Coal per ihp-hr., lb	1.16	1.195	1.195
Coal per kw-hr., lb	1.94	1.96	1.93
Boiler and superheater efficiency, per cent	76.9	76.6	77.0
Thermal efficiency of engine, per cent	19.8	19.7	19.5
Thermal efficiency of unit, per cent	15.6	15.1	15.0
Heat value of coal, lb.-Fahr. thermal units	14136	14099	14215

average results of seven tests using Pocahontas coal. Column A shows the average of three tests run at about 95 per cent of the rated load. Column B shows the average of two tests at 14 per cent overload, and Column C gives the mean of two tests at 36 per cent overload.

A feature of the economy curves obtained has been their "flatness," demonstrating the ability of the locomobile unit to handle large overloads with a scarcely perceptible loss of efficiency. While not shown in this series, other tests prove that the same valuable characteristic is possessed at underloads as well. The fuel consumption at three-quarter load is indeed within 5 per cent of the rated efficiency and even at half load the coal consumption is less than 20 per cent greater per horse-power than at rated load.

In comparing these results with data on other power plants it should be remembered, said Mr. Cooper, that the locomobile is essentially a small or moderate-sized plant. Small steam plants of ordinary types are usually quite wasteful of fuel for several reasons. In the first place small engines are almost always of the high-speed, non-condensing type, using 30 lb. to 40 lb. of steam per hp-hr. Radiation losses are also relatively greater in small plants, owing to the fact that small boilers, cylinders and pipes

expose more surface per pound of steam carried than large ones.

The locomobile therefore presents means of reducing energy costs in a 50-hp or 75-hp plant to values as low as or even lower than those achieved by the large plant with its big units. This fact is further elucidated in Table II, which shows the distribution of the heat losses and the comparative fuel consumptions of a number of typical power plants. Mr. Cooper drew special attention to the fact that in the case of the simple-engine plant at the bottom of the table less than 4 per cent of the heat of the fuel is converted into work, while the condensing Buckeye-mobile shows an efficiency of 17 per cent, and the non-condensing Buckeye-mobile one of 12 per cent.

TABLE II—COMPARATIVE PERFORMANCE OF STEAM PLANTS

Type of Plant	Lb. Steam per Hp-hr.	Boiler Efficiency, per Cent	Lb. Coal per Ind. Hp-hr.
Condensing Buckeye-mobile	9.2	76.3	1.08
Non-condensing Buckeye-mobile	12.9	74.0	1.45
Large compound condensing plant with economizers	....	73.7	1.71
High-grade compound non-condensing plant.	20	70.0	2.07
High-grade condensing, simple engine	20	70.0	2.27
Good non-condensing, simple engine	24	70.0	2.5
Good non-condensing, simple engine	24	60.0	2.91
High-speed non-condensing, simple engine	30	60.0	3.66
High-speed non-condensing, simple engine	30	50.0	4.38
Simple engine as above, without feed-water heater	....	50.0	5.03

Unbalanced Phases

By J. A. Horton

The engine-room operator of an industrial concern noticed that two of the three fuses in a three-phase line leading from the busbars to a three-phase motor operating a fan were heating, while the third fuse was comparatively cool. At the same time he noticed that the blower motor was running hotter than usual, although another motor on the same circuit showed no such tendency so far as could be ascertained by feeling it with the hand. A voltmeter indicated the voltages of the three phases to be balanced at the switchboard but to be unbalanced at the motor, which was about 600 ft. distant. Three ammeters cut into the three motor leads the next day indicated the phase currents to be balanced at a current value about 10 per cent above the full-load current rating of the motor. Reapplication of the voltmeter showed the voltages of the three phases to be balanced at 222 volts, normal voltage being 225 volts. A test of the other motor on the same circuit showed its voltages and currents to be perfectly balanced.

Apparently there was now nothing the matter with anything. As a matter of fact, this was the case. However, between the time of applying the voltmeter in the first place and of applying the voltmeter and the ammeters the day after the engineer had made a change without saying anything about it. The fuses in question had two three-phase circuits leading from them. With the intention of relieving the fuses, so that he would not have to replace them so often, the engineer took the three conductors of one circuit and transferred them to another set of fuses. In making the transfer to the new set of fuses one of two grounded legs was removed from the system, and in again connecting the three legs to the system the engineer happened to get the transferred grounded leg mated with the busbar that was already grounded through the untransferred grounded leg. In other words, before making the change the two grounds were on legs of different polarity and produced a partial short-circuit; after the change the two grounds were on the same leg in effect, so that the short-circuit was removed. The reason that one motor showed heating and the other did not was that the hot motor was already operating at overload, while the motor that was cool was operating comparatively light. Of course, a dead short-circuit would have blown the fuses as fast as they could be replaced; but it is conceivable that one of the grounds included part of the reactance of one of the compensators to limit the current to a certain extent. It would have been interesting to ferret out the actual cause of the trouble, but both of the motors were on work that could not be interrupted for ringing out.

"Angular Parallel" Connection of Series Transformers

I frequently see wiring diagrams showing the secondaries of two series transformers in a three-phase system connected in so-called "angular parallel" arrangement. How is this connection possible if the emfs in the two secondaries are out of phase with one another? And, even if they were in phase, what would prevent the flow of current in the local circuit formed by the secondaries and the cross connections when the load is unbalanced? H. M.

The use of two series transformers in a three-phase system to show currents in all three leads represents an extremely interesting application of transformers, since it brings to the front several of the peculiar features of ordinary transformers usually neglected when considering these devices operated at constant potential and varying current. The secondary current of a series transformer can be safely assumed to bear a constant ratio to the primary current and to be directly in phase opposition to this current. The secondary circuit of two series transformers can be so interconnected that the separate currents are superposed in such a way as to produce a resultant third current, which may then be either the vector sum or the vector difference of the other two currents. The voltage assumes the value required to force the indicated amount of current through the impedance of the interconnected circuits. The secondary currents in two series transformers in a balanced three-phase system may be so superposed as to produce a resultant current exactly equal to each of the two secondary currents, or they may be so superposed as to produce a resultant current equal to 1.73 times the value of each of these currents. Obviously the correct method of superposition is that giving a value to the resultant current exactly equal to each of the other two currents. When the transformers are interconnected as just indicated the resultant current under every condition of balance or unbalance is exactly equal to—or proportional to—the current in the third lead of the three-phase system.

Connections of Wattmeters and Power-Factor Meters

Please explain the method of connecting a wattmeter and a power-factor meter in circuit, both directly in series with the line and with the use of a current transformer. J. S. H.

In connecting with a wattmeter or a power-factor meter in a circuit, the so-called "current coil" is connected in series with the line, and the "voltage coil" is connected across between the two leads. The condition is not changed when use is made of a so-called "current transformer," which transforms voltage as well as current and can best be designated as a "series" transformer because of its connection in the circuits. The secondary coil of the series transformer is connected in series with the current coil of the wattmeter, and also in series with the current coils of any watt-hour meter or power-factor meter that may be used in the same system. The series transformer serves merely to insulate the apparatus from the leads of the system and to reduce the current in the correct proportions for use in the wattmeter, power-factor meter or frequency meter.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Phase Compensation.—G. H. EARDLEY-WILMOT.—After referring to the importance of improving the power-factor in distribution systems the author describes two classes of rotary phase compensators, namely, those having no stators and those provided with stator windings. The features of the statorless type, as built by Brown, Boveri &

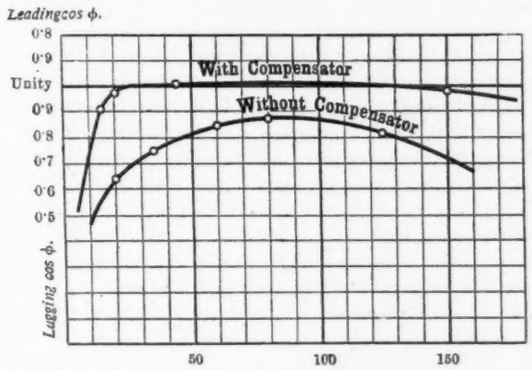


FIG. 1—CURVES SHOWING POWER-FACTOR OF A 100-HP INDUCTION MOTOR WITH AND WITHOUT COMPENSATOR

Company, are outlined, the performance of these machines being shown by curves. Examples are also given of its applications. With the statorless compensator there is no improvement of the power-factor at no load, but the degree of compensation possible reaches its maximum at about quarter load. The power-factor curve with the compen-

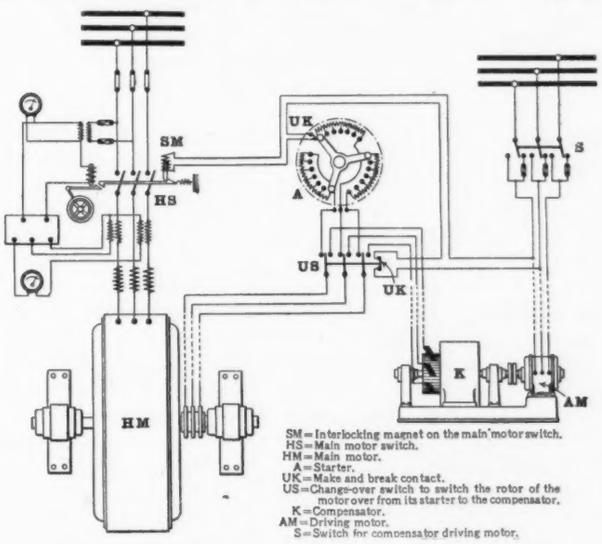


FIG. 2—DIAGRAM OF PHASE-COMPENSATING DEVICE

sator in operation then follows a straight line up to a point between 25 per cent and 50 per cent overload, after which it starts to drop off. This is borne out by Fig. 1, which shows actual test curves taken on a 100-hp induction motor fitted with a statorless compensator. In spite of the absence of a stator, commutation is very good, although these compensators cannot be built for such large currents as those designed for use with stator windings. A diagram of the general arrangement of a phase-compensating device is given in Fig. 2. It is important that the main switch shall not be closed unless both the starter and change-over switch *US* are in the starting position and unless the compensator set is running. If this were done—that is to say, if the main switch were closed when the change-over switch was so closed that the circuit between the rotor and the compensator was completed and the compensator itself were not running—the full rotor standstill pressure would be put across the brushes, probably resulting in the auxiliary machine being burned out. For this reason it is best to install some kind of interlocking device, and such a device is shown in the diagram in Fig. 2. Another point which should be noted is that the slip of the main motor is somewhat increased when a phase compensator is working in conjunction with it. In some cases the slip is as much as doubled, and this might make a very appreciable difference to the full-load speed of the motor, though such a large increase in the percentage slip would probably occur only in the case of large motors and when the normal slip is low.—London *Electrician,* Nov. 28, 1913.

Amortisseurs.—P. BOUCHEROT.—The continuation and conclusion of his long mathematical article on the damping of alternators and the effect of amortisseurs (damping coils). The theory is given, first approximately, and later more rigidly.—*La Lumière Elec.,* Nov. 15 and 22, 1913.

Lamps and Lighting

Nitrogen-Filled Tungsten Lamp.—K. MEY.—A translation in abstract of a German paper read before the German Association of Electrical Engineers on the Allgemeine Elektricitäts Gesellschaft "nitra" lamp, which is the German trade name for the new nitrogen-filled tungsten lamp operating at a specific consumption of 0.5 watt per cp.—London *Electrician,* Nov. 28, 1913.

Generation, Transmission and Distribution

Swedish Water-Power Plant.—A long and profusely illustrated description of the power plant at the Porjus waterfalls which has been erected to supply energy to the state railway from Kiruna to Riksgränsen. This road has a length of 129 km (77 miles) and carries a great deal of freight and iron ore. When complete the power plant will contain ten generating sets, each rated at 8800 kw. For traction purposes single-phase current will be generated at 15 cycles and 4000 volts. For the energy requirements of the mines and metallurgical works three-phase, 25-cycle current will be generated at 10,000 volts.—*Elek. Kraftbet. u. Bahnen,* Nov. 14, 1913.

Trollhättan.—An illustrated article on the Trollhättan power plant of the Swedish government, which has a capacity of 80,000 hp. There are six three-phase generators, each rated at 9000 kw. Energy is generated at 10,000 volts to 11,000 volts. For transmission the pressure is raised to 50,000 volts by three groups of single-phase transformers. The largest substation is at Gothenburg, which is at present equipped with seven single-phase transformers, each rated at 3300 kva.—*Elek. Zeit.,* Nov. 27, 1913.

German Power Plant.—MAYER.—An illustrated article on the electricity supply of the city of Stettin, Germany. The power plant of the former Stettin electric company has been taken over by a new municipal corporation formed by the

municipality of Stettin, the province of Pommern, and three agricultural counties. The generating plant has been changed from direct-current to three-phase. The direct-current generators have been replaced by two three-phase, 5100-volt generators, each rated at 750 kw, and two new steam turbine generators, each rated at 3500 kw. The three-phase currents are transmitted to three substations. Distribution within the city is made by direct current and in the agricultural districts by three-phase alternating current.—*Elek. Kraftbet. u. Bahnen,* Oct. 24, 1913.

Traction

Trolley-Wire Construction.—W. von Moellondorff.—An illustrated article advocating the standardization of trolley wires and trolley poles. For trolley contactors in the form of sliding bows, aluminum-copper alloys have been extensively tested during the last few years. An alloy of commercial aluminum (98 to 99 per cent pure) with 6 per cent of copper has proved the best, since it is hardest and maintains a bright surface.—*Elek. Zeit.,* Nov. 27, 1913.

German Railway Accidents.—H. Alertz.—Statistical data of accidents on German electric railways during the year 1912. The report covers 173 railway systems. Thirty systems had no serious accidents; on the other 143 systems there were 239 persons killed (25 passengers and 214 people on the street), and 1128 persons were seriously injured.—*Elek. Kraftbet. u. Bahnen,* Nov. 24, 1913.

Wires, Wiring and Conduits

Protective Relays.—Emil Hausser.—A long article, illustrated by diagrams, describing the use of relays for the protection of generators, rotary converters, motors and transformers and the use of protective relays in connection with busbar sets, feeders and lines connecting power plants with ring distribution systems. The fundamental principles of operation of different types of relays are also described.—*Elek. Kraftbet. u. Bahnen,* Nov. 4 and 14, 1913.

Suspension Insulators.—P. Gesing.—An illustrated paper on methods of calculating the mechanical strength of overhead transmission lines with suspension insulators.—*Elek. Kraftbet. u. Bahnen,* Nov. 24, 1913.

Electrochemistry and Batteries

Electric Conductivity Imparted to Liquid Air by Alpha-Rays.—J. C. McLennan and D. A. Keys.—In a number of experiments it has been shown, in agreement with a number of other experimenters, that liquid air when freshly filtered is an extremely good insulator, and that its conductivity, in the absence of any ionizing radiation other than that from the earth, is much the same as that of ordinary clean air at atmospheric pressure. The dielectric constant of liquid air was found to be 1.43. The saturation current obtained in air at ordinary pressure by the complete absorption of the alpha radiation emitted by a plate coated with polonium was found to be about sixteen times the maximum current obtained with the highest fields used when the radiation was absorbed in air at 101 atmospheres, and about 576 times the maximum current obtained in liquid air when the ionization was produced by the same radiation. The mobility of the positive ion produced in air at 116 atmospheres by alpha rays was found to be 0.0005294 cm second per volt cm, and that of the negative 0.0006217 cm second per volt cm, the latter being about 1.18 times the former. In the course of the investigation evidence was found of the existence of a penetrating radiation emitted by the layer of polonium which furnished the alpha rays.—*Philos. Mag.,* November, 1913.

Radiology.—C. Ramsauer.—An illustrated description of the equipment of the new Physico-Radiological Institute of the University of Heidelberg.—*Elek. Zeit.,* Nov. 27, 1913.

Units, Measurements and Instruments

Definition of the Ohm.—The official committee of the French Parliament which is charged with drafting a law giving definitions of units of measurement has concurred on the metric system using the fundamental units of the meter, the kilogram and the second, and has also defined three other fundamental units—the centigrade degree of temperature, the ohm, and the bougie (decimal of candlepower). The ohm is defined as "the resistance offered to a constant current by a column of mercury of uniform cross-section at a temperature of zero deg. C. with a length of 106,300 cm and a mass of 14.4251 grams, according to the definition of the international ohm of the International Conference held in London in 1908."—*La Lumière Elec.,* Nov. 22, 1913. The definitions of the meter, the kilogram and the second are given in *La Lumière Elec.,* Nov. 29, 1913.

Thermo-Electric Calorimeter Bomb.—A description of a new calorimeter bomb of Ch. Fery. It is distinctive in that no water is used as the calorimetric mass, the metal of the bomb taking its place, and, second, the rise of temperature produced by the combustion of the sample is evaluated by a thermo-electric process. The apparatus, as shown in Fig. 3, consists of the calorimetric bomb proper, maintained in the center of a metallic envelope *A* by a disk *E*. The combustible under test is placed in the capsule *J* and is ignited by a magneto current sent through a fine wire running between the rods *K*. *D* is the outside coating. Previous tests having shown that thin steel does not insure perfect conductivity of heat, thus leading to lack of uniformity in results, red copper 3 mm to 4 mm (0.118 in. to 0.157 in.) thick is now used for the coating. *C* is the inside nickel coating which can be easily removed in order to weigh the moisture formed. The capsule *J* is always placed at the same height by means of an adjustment shown on the rod supporting it. The current to the wire located between the rods *K* is brought in from the outside contact screws *G*. Oxygen is admitted through the cock *F* and is thrown out in four horizontal jets, so as to avoid blowing away the combustible if the latter happens to be in the state of powder. The heat produced is read from the milli-voltmeter *L* either in millivolts or directly in calories, the latter being possible, of course, only when the amount of combustible is equal to the unit weight for the system of heat units used. Tests made with instruments at the Laboratory of Arts and Trades in Paris have shown the reliability of the instrument.—*La Génie Civil,* Vol. 63, No. 21, page 415, Sept. 20, 1913; abstracted in *Journal* of the Amer. Soc. Mech. Eng., November, 1913.

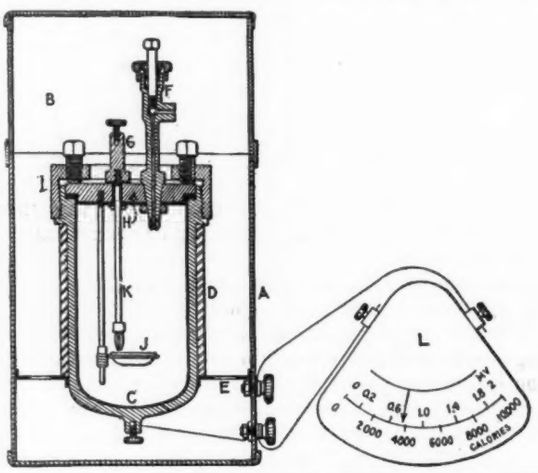


FIG. 3—THERMO-ELECTRIC DIRECT-READING CALORIMETER BOMB

Insulation Resistance.—S. Evershed.—The first part of a paper read before the (British) Institution of Electrical Engineers in which the author describes a number of experiments undertaken on various dielectrics, including cotton, paper and micanite cloth. The nature of insulation resistance is discussed and its dependence on certain factors, especially the pressure applied and moisture, is shown. The properties of a model insulator are dealt with. The

present instalment contains a description of the method of investigation, notes on typical examples of insulation, methods of measurement of dielectric resistances, and moisture curves for cotton, paper and micanite cloth.—London *Electrician*, Nov. 28, 1913.

Telegraphy, Telephony and Signals

Telephone Relay.—EUGEN REISS.—A long illustrated paper read before the Electrical Society of Berlin on a new telephone relay using a cathode-ray discharge tube

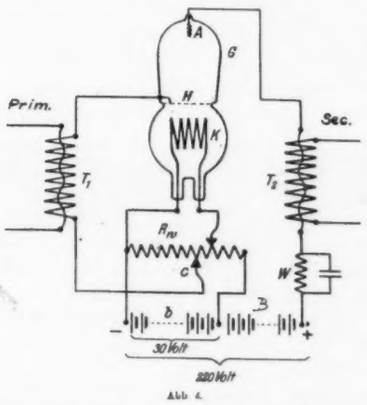


FIG. 4—APPARATUS FOR AMPLIFYING TELEPHONE CURRENTS

and based originally on the idea of Robert von Lieben. In the earlier construction the cathode rays were deflected magnetically by the currents the amplitude of which was to be enlarged. A different method is used, however, in the latest construction which is shown in Fig. 4. Here *G* is an evacuated glass container with three electrodes, namely, the cathode *K*, the auxiliary electrode *H* and the anode *A*. The auxiliary electrode fills the whole cross-section of the tube, but is perforated so as to permit passage of the current between the anode and cathode, which are connected to the battery *B*. The Wehnelt cathode *K* consists of a zigzag platinum ribbon wound on a glass tube, the platinum ribbon being covered with a thin film of barium oxide and calcium oxide. The cathode is brought to red heat at about 1000 deg. C. by means of a small 30-volt battery *b*. The primary currents, the amplitude of which is to be increased, act through the transformer *T* upon the circuit containing the cathode *K* and the auxiliary electrode *H*. The secondary currents—that is, the currents increased in amplitude by the relay—are taken from the secondary winding of the transformer *T*. The methods of adjusting the relay so as to get maximum sensitiveness are described. In order to have a mercury-vapor atmosphere, some amalgam is used in the discharge tube. As the device is now built by the Allgemeine Elektricitäts Gesellschaft (Fig. 5), *g* is the glass globe and *A* is the anode consisting of a spirally wound aluminum wire of 2 mm diameter. The auxiliary electrode *H* is also made of aluminum and has holes 3.5 mm in diameter uniformly distributed over its whole surface. The cathode consists of platinum ribbon 1 mm broad and 0.2 mm thick, covered with a thin film of calcium oxide and barium oxide. In order to obtain increased sensitiveness, it is is possible to use several relays in cascade connection. If four relays are used in this way, the amplitude of the currents can be increased 20,000 times. The principal advantages of the relay are that it is non-sensitive with respect to mechanical vibrations and that it is practically free of inertia so that the wave-form is exactly reproduced. The same issue contains an account of the discussion which followed the paper. Ebeling agreed that this Lieben relay is more reliable than the mechanical relay of Brown, but the latter is somewhat simpler. Experiments are being continued by the German Telephone Department with both types of relays.—*Elek. Zeit.*, Nov. 27, 1913.

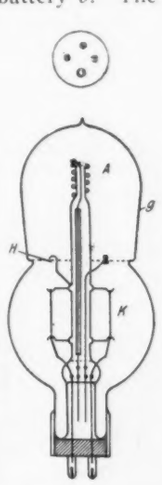


FIG. 5 — NEW CATHODE TUBE RELAY

Miscellaneous

Balkan States.—An article giving statistical data on the condition of the electrical industries in the Balkan States (especially imports from Germany) since the war.—*La Lumière Elec.*, Nov. 15, 1913.

Ghent.—J. REYVAL.—The first part of an article on generating sets and the Ghent exhibition. The present instalment gives details of a 1000-hp four-cylinder Carels-Diesel oil engine which drives a 600-kw alternator.—*La Lumière Elec.*, Nov. 8, 1913.

Book Reviews

MASSE UND MESSEN. By Dr. Walter Block. Leipzig: B. G. Teubner. 112 pages, 34 illus. Price, 1.25 marks.

A brief treatise on physical metrology, in Teubner's "Natural and Intellectual World Series." It describes in a practical but scientific way the principal measures of length, mass, time, heat and electricity. The chapters relate to the following subjects: The metric system, principles of measurement, mechanical quantities and measures, thermal quantities and measures, optical quantities and measures, electric quantities and measures. The final chapter gives a brief idea of the theory of relativity. The treatment is simple and clear. The chapter on electric measures is not so modern in treatment as the rest.

HIRSCH WILKING ELEKTRO-INGENIEUR-KALENDAR, 1913. Edited by Arthur H. Hirsch and Max Barth. Thirteenth year. Berlin: Verlag von Oscar Coblentz. 373 pages, leather, illus. Price, 2.5 marks. Notebook supplement.

The thirteenth yearly appearance of this electrical-engineering calendar and pocketbook is signalized by this volume. The calendar contains a handy series of tables but does not contain many connection diagrams. Appended to the tabular matter is an excellent series of rules and regulations which are likely to be very useful. Curiously enough, the first page after the table of contents gives a graphical comparison between the centimeter and the Rhenish inch, which is about one-sixty-fourth longer than the English inch. A convenient loose-leaf diary accompanies the calendar.

GRUNDLAGEN DER ELEKTROTECHNIK. By A. Rotth. Leipzig: B. G. Teubner. 126 pages, 72 illus.

This elementary treatise discusses the principles of electricity and magnetism, leading to a discussion of direct-current and alternating-current dynamos and motors. Only the simplest of algebraic formulas are used in the quantitative elucidation of these principles. The book is divided into three chapters, dealing respectively with general principles of electric currents, direct currents and alternating currents. The entire treatment of the subject is extremely simple and is based on experimental demonstrations. The author's work would have been more compatible with international agreement had the symbols used for expressing Ohm's law been those adopted internationally, but except for such details the matter is very well presented. The book will commend itself to persons who, familiar with the German language but unacquainted with electrotechnics, desire an understanding of the fundamental principles of dynamos and motors.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric Water Heater

The 660-watt electric water heater illustrated herewith has been added to the line of heaters made by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. The new heater has a water capacity of 3 qt. and can be attached to any lighting circuit.

A small pilot lamp under a ruby-glass lens is arranged at the base of the heater and indicates when energy is being used. A two-button flush switch is mounted in the base. The heater is provided with a frosted-glass globe, decorated with cut-glass stars, and the base is heavily nickel-plated. The heating unit can be readily renewed.

This heater is particularly intended for use in buffets, restaurants and drug stores for providing hot drinks at the

WATER HEATER

bar or soda counter or for furnishing hot water for any purpose. It is also well adapted for home service.

Electric Wheel Chair for San Francisco Exposition

A concession has been made to the Motor Chair Company, Chicago, to operate 200 of its motor-driven chairs at the Panama-Pacific Exposition in San Francisco in 1915. These chairs will seat two passengers and will be operated in a manner similar to the familiar "man-power" chairs now in service at Atlantic City, Palm Beach and other resorts.

A 0.5-hp compound-wound driving motor placed under the chair seat is connected to the two rear wheels of the chair through pinion-and-sprocket and chain reductions. Energy for operating the chair is drawn from a 12-volt, 150-amp-hr. Edison storage battery under the wicker dash. The motor runs at 1200 r.p.m. and the speed of the chair shown herewith is 3.5 miles an hour. It is said that chairs may be built with different reductions, giving speeds ranging from 1 mile to 10 miles an hour.

The feature of the chair, as described by Mr. Charles B. Chrysler, its inventor, lies in the control. A small foot pedal actuates the braking mechanism and the controller under the floor of the car. By various pressures on the

ELECTRIC WHEEL CHAIR

pedal the controller can be operated over four successive speeds ahead. Release of the pedal sets the brakes automatically. Twenty-four inches is given as the average distance which the chair will travel with brakes set.

Cordless Jack Boxes for Way-Station Service

A cordless jack box for connecting the operator's set in a railroad way station to one or more lines passing through the station has been developed by the Western Electric Company, New York. This device does away with the knife-switch method of cutting in the operator's telephone or telegraph set on the train-dispatching lines. With the

CORDLESS JACK BOX

new box the connection is effected by means of a single-conductor plug, which is inserted in the line jack corresponding to the line over which it is desired to talk or telegraph.

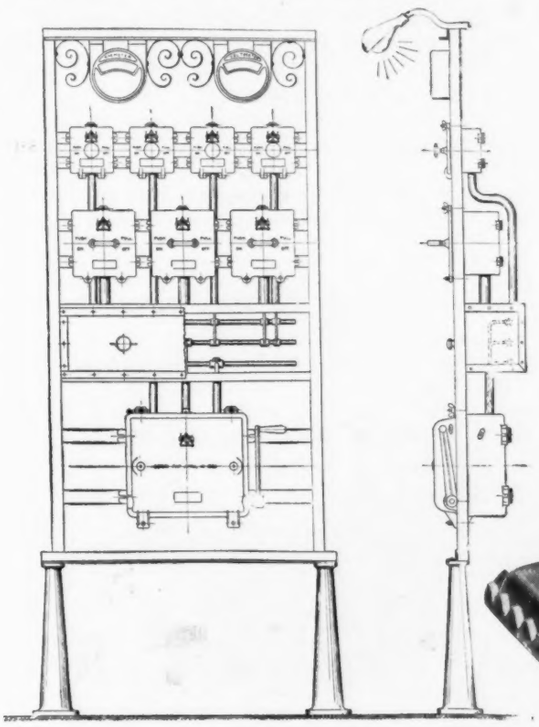
The jack used in the boxes for telegraph lines is different from that employed with the telephone circuit, a special jack being necessary for the telegraph apparatus. The tele-

phone jack boxes may be used to connect two or more lines together and at the same time have the operator's set bridged in on all of them by using one or more extra switching plugs. The jacks are thoroughly insulated to prevent trouble from sudden voltage surges or accidental crosses with transmission or lighting circuits, while all the jack springs are widely separated to prevent arcing and burning of the insulation. Screw terminals are used for connecting in outside lines, soldering thus being rendered unnecessary. A tie cord is furnished with the switching plug to keep the latter from being mislaid when not in use.

These boxes are manufactured in three sizes—one type for three lines, another for six lines and another for twelve lines, the latter consisting of two six-line units hinged together. Any of the jack boxes can be ordered partially equipped with dummy wooden plugs in the unequipped spaces, and jacks can be added at any time by knocking out the wooden plugs and screwing in the jacks.

Ironclad Switchboard

The switchboard shown in the accompanying drawing is the product of the Detroit Fuse & Manufacturing Company, Detroit, Mich., and is of the "ironclad" type designed particularly with the idea of safety in mind. The framework is made of angle iron securely bolted together. The switches are entirely inclosed in cast-iron boxes and may be operated from the outside. The busbar chamber is constructed of sheet iron with a cover of the same material. The fuses are contained in the switch units specially employed with this type of board. No "live" metal parts are exposed. As the space is open between the switch units all connections may be made from the front.



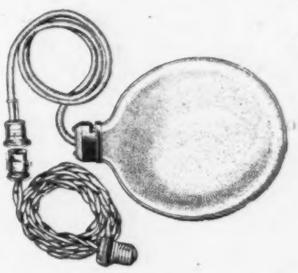
IRONCLAD SWITCHBOARD

A guard rail in front of the panel is unnecessary and no space is needed in the rear. The panels may be provided with any number of different sizes of switches, being limited only by the size of the framework.

Carrying out the safety idea, all working parts and electrical connections are inaccessible to the operator under ordinary working conditions. The switches used are semi-automatic in action, the completion of the operation being beyond the control of the operator. Fuses can be readily changed without danger of accidents. By thoroughly grounding the outer case and the lever of the switch before the electrical connection can be completed, the liability to shock is eliminated.

Electric Heating Pad

The Hotpoint Electric Heating Company, Ontario, Cal., has placed on the market an aluminum-cased heating pad. As illustrated herewith, the pad is made convex on one side



HEATING PAD

and concave on the other to fit the curve of the body. The heat control is designed to maintain any desired temperature between 100 deg. and 200 deg. Fahr., while the average energy consumption amounts to 40 watt-hr. per hour. The device is 8 in. in diameter and 0.625 in. thick and weighs 1.25 lb. The pad is effective in a wet pack and for bed-warming.

Heavy-Duty Test Clip

R. S. Mueller & Company, Cleveland, Ohio, have brought out a new heavy-duty test clip, which is shown full-size in the accompanying illustration. This clip is called the "big brute" and is said to be able to carry 100 amp indefinitely without heating. When applied to flat surfaces where the jaws make good contacts it will carry 200 amp without excessive heating.

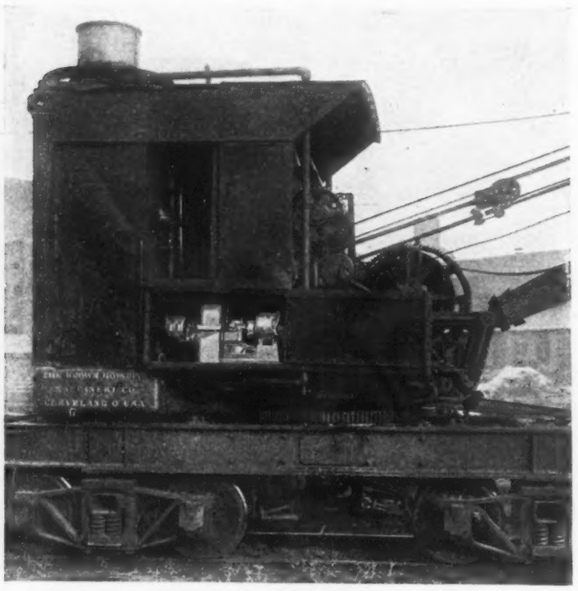
The outer members are made of an alloy containing 90 per cent copper. One of these is toothed around its edges, while the other is plain, the latter nesting firmly into the former. The inner member, acting as a spring, is made of blued steel with the points of application near the jaws. This gives a long leverage, which results in a strong "bite" and a firm contact.

Copper sheaves are placed under the spring to carry whatever current is picked up by the toothed member to the side attached to the connecting cord, and also to act as a shunt around the spring to protect the latter from heavy currents which might otherwise affect the temper. The jaws have a spread of 0.875 in. The nose is not thick or rounded, which is an advantage in close quarters. Often where the space is limited a contact can be made with the side jaws where there would not be room to apply the nose.

TEST CLIP FOR HEAVY-DUTY WORK

Turbine Generator for Crane Electromagnets

In order to avoid the necessity for dragging service wires along the track on which locomotive cranes using electromagnets work back and forth the 15-ton crane illustrated herewith has been fitted by the Brown Hoisting Machinery Company, Cleveland, Ohio, with a 5-kw turbo-generator set, built by the Terry Steam Turbine Company, Hartford,



CRANE WITH ELECTROMAGNETS

Conn. The electromagnet energized by current from this unit is used for handling pig iron and scrap at any point within the reach of the 40-ft. boom.

The crane is operated by a reciprocating engine. The small generator set, which is entirely independent of the other operating parts of the mechanism, is mounted as shown in a compartment beneath the floor of the operator's cab, where it is entirely out of the way.

Porcelain Strain Insulators

The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has recently developed two new types of porcelain strain insulators designed particularly for heavy overhead construction. These insulators combine a metal cap and a porcelain skirt to furnish the required dielectric strength. The metal parts consist of a malleable-iron

INSULATORS FOR HEAVY OVERHEAD CONSTRUCTION

cap, a drop-forged steel eye bolt and a malleable-iron sleeve by which the eye-bolt is securely fastened.

The metal and porcelain parts are cemented together with high-grade Portland cement, the cemented surfaces being corrugated to prevent failure except by actual shearing of the cement. The skirt of the porcelain also has corrugations on the under side to give additional creepage surface.

These insulators are made in two sizes. The metal parts of the smaller are sherardized and those of the larger are hot-galvanized. The smaller insulator is especially used for insulating cables when the working load does not exceed 1600 lb. Both insulators are tested at 5000 lb., being generally used for heavy service, such as dead-ending high-strength steel messenger cables with a working load of 4000 lb. for the smaller type and 8000 lb. for the larger.

Compensated Polyphase Motor

The Bell Electric Motor Company, Garwood, N. J., is manufacturing a polyphase induction motor which can be brought up to full speed by throwing it directly on the line without any external resistance. The rotor has two sets of windings. A high-resistance winding similar to that used in direct-current motors is placed in the bottom of the rotor slots and is connected to the commutator. Another high-resistance winding similar to a squirrel-cage winding is placed in the top of the slots. No brushes are required.

At starting the squirrel-cage winding is used to bring the motor up to speed, and when full speed is nearly at-

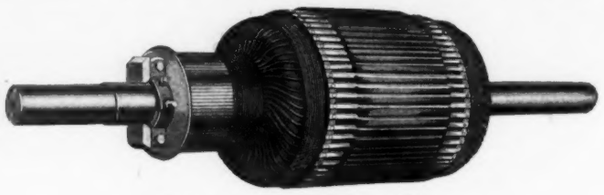


FIG. 1—COMPENSATED ROTOR

tained the commutator is short-circuited by means of a device, consisting of a plate of phosphor bronze, which is pressed against the commutator segments by two weights that are thrown out by centrifugal force. The rotor thereafter operates with a low internal resistance. The motor can thus be started automatically, since opening or closing the switch is all that is necessary to start or stop the machine. When the motor stops running, a large spring forces the plate of the short-circuiting device back to its

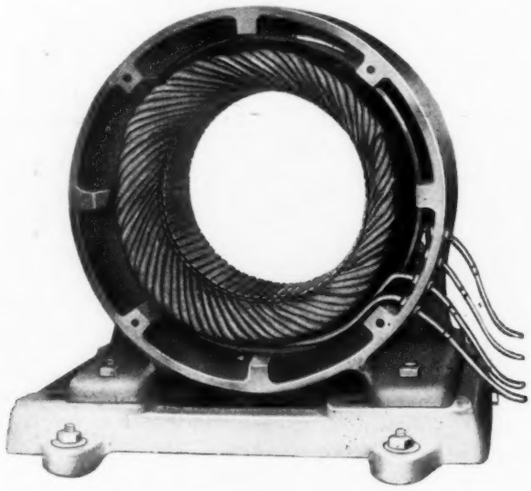


FIG. 2—STATOR OF COMPENSATED POLYPHASE MOTOR

original position, and the motor is then ready to start again.

The starting current varies from two to two and one-half times full-load running current. The motor will start under full load. By means of the two independent windings a double transformation results. This reacts on the stator winding, and raises the power-factor of the motor.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Electrical Manufacturer to Handle Automobile Accessory.—The Electric Renovator Company, of Pittsburgh, Pa. maker of electrically driven vacuum cleaners, has frequently absorbed the Harroun Company, of Indianapolis, Ind., maker of the kerosene carburetors.

Engineers Specializing in Utility-Regulation Work.—William J. Norton and Paul P. Bird have severed their connection with the Commonwealth Edison Company and formed the firm of Norton & Bird, consulting engineers, making a specialty of public utility work. The new firm has its office at 72 West Adams Street, Chicago, and will specialize in rate reports and rate schedules, the preparation of reports required by federal and state authorities, the preparation of cases before public service commissions and the like. It will do much of the work of the Commonwealth Edison Company and other Insull companies before public utility commissions.

General Electric Sales to Utility Companies.—Three companies have recently placed orders with the above manufacturer for generating and auxiliary equipment. The Minneapolis & Ontario Power Company, Minneapolis, Minn., will place in operation in its station at International Falls, Minn., new apparatus consisting of a 2000-kw Curtis turbo-generator with 17.5-kw motor-generator exciter set, 5-hp and 25-hp motors, pumps and condenser equipment. The California-Oregon Power Company, Yreka, Cal., will add to the equipment of its station two 50-kva, one 100-kva and four 200-kva transformers, recently ordered. The United Electric Light & Water Company, Waterbury, Conn., will add to its station equipment three 600-kva transformers and accessories.

Westinghouse Sales Activities.—The Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., has recently received from one large operating company an order for 10,000 electric irons. This is an unusually large single order for this class of apparatus. Among the orders recently placed with the Westinghouse Machine Company is one from the Pennsylvania Railroad for two 35,000-hp turbines, with surface condensers and other power-house apparatus, for the Long Island power house, which furnishes part of the power for the operation of the Pennsylvania tunnel system under New York City. The Norfolk & Western Railway Company has also placed an order with the machine company for three 10,000-hp turbines in connection with its electrification plans, and the Hamilton Electric Light & Power Company, Ltd., of Hamilton, Ont., has contracted for two 15,000-hp turbines.

Motor-Driven Aerial Tramway Across the Andes Mountains.—English interests in Colombia are planning to start work soon on the construction of an aerial tramway, about 37½ miles long, between Mariquita and Manizares. The ropeway, which will cross the Andes Mountains at an elevation of about 11,000 ft., will be built in twelve sections. At the junction point of each two sections an electric motor, of sufficient capacity to operate both sections, will be installed. The steel cable will be supported by structural steel towers, varying in height from 40 ft. to 125 ft. The energy for the motors will be generated hydroelectrically. A station will be built near Mariquita and two generators will be installed. The tower work is being done in the United States, and the cable, electrical equipment and power-house machinery will be supplied by English companies. It is expected that the work will be completed by Jan. 1, 1915.

Electrical Dealers Find that Location Affects Class of Business.—Sibley & Pitman, of 19 West Thirty-Sixth Street, New York City, are making extensive changes in their store arrangements in order to take care of the growth of their business. In the old down-town store a good business was done in a few standard lines of wiring specialties, but with their change of location they have experienced an unexpected growth along new lines. A large demand for domestic appliances has been noticed by them here, and they have recently put in a line of wireless apparatus to meet another new demand. The location of the new showroom, in close proximity to an active shopping center, results in larger sales of the heating and cooking and lighting appliances, although a good business is done in other lines. At present the store is reflecting the holiday spirit, and some electric toys are to be seen there, in addition to the regular lines.

Litigation Relating to Telephone Competition in Illinois.—Seventy-eight bondholders of the Interstate Independent Telephone & Telegraph Company have brought suit in the Circuit Court of Cook County, Illinois, charging that H. H. Evans, of Aurora, and B. E. Sunny, president of the Chicago Telephone Company, conspired to wreck the company and drive it out of competition with the Bell companies in central Illinois. The American Telephone & Telegraph Company, the Chicago Telephone Company, the Central Union Telephone Company and the First Trust & Savings Bank of Chicago are also named as defendants. Mr. Evans was president of the Interstate company until September, 1910. According to the bill of complaint, the defendants, or some of them, entered into a systematic effort to depreciate the market value of the stocks and bonds of the Interstate company. The court is asked to inquire into the transactions, contracts and agreements entered into during the year 1910 between Messrs. Evans and Sunny and the Bell companies. The Interstate company operated in Aurora, Joliet, Elgin, Peoria, Springfield, Sterling, Morrison and other cities of Illinois.

Steel and Iron Industries Increasing Electrical Equipments.—Elsewhere in this section note is made of the sale of boiler equipment to three of the large steel companies, and the expansion of that industry can be seen also in an increased demand for electrical apparatus. The Eastern Metal Corporation, New York City, will place in operation shortly in its power plant at Bayonne, N. J., a 370-kva, two-unit, three-bearing motor-generator set with blower equipment and switchboard. The United States Aluminum Company, Pittsburgh, Pa., will add to the electric drive equipment of its plant ten 20-hp induction motors with starting compensators recently purchased. The Standard Steel Car Company, New Castle, Pa., will install for electric drive fifty-four motors ranging in capacity from 5 hp to 50 hp. The Chase Rolling Mill Company, Waterbury, Conn., will add to the electrical equipment of its plant a 750-kva alternating-current generator recently purchased. The Union Iron Works, San Francisco, Cal., will install in their mills four additional 200-hp induction motors with starting compensators. In each of these cases the apparatus to be installed has either been obtained from the General Electric Company or an order has been placed with that concern for it.

Good Boiler Sales Reported.—The Babcock & Wilcox Company, of 85 Liberty Street, New York, has reported among some of the larger sales recently made an aggregate of 14,823 hp of boiler equipment. It is particularly significant at the present time to note that three of these large orders are from big steel companies, the American Iron & Steel Manufacturing Company, Lebanon, Pa., taking 1040 hp, the Minnesota Steel Company, of New Duluth, Minn., 1311 hp, and the Columbus (Ohio) Iron & Steel Company, 1776 hp in boilers. Another industrial company which has recently taken equipment of this kind is the Newport News (Va.) Shipbuilding & Dry Dock Company, to which 1480 hp

in boilers was supplied. Electrical generating companies on the list are the Miami (Fla.) Electric Light & Power Company, with 1040 hp, and the Western Gas & Electric Company, of Aurora, Ill., with 1004 hp. The largest order reported was for 2540 hp of boilers, with chain-grate stokers, sold to the Atchison, Topeka & Santa Fé Railway, Topeka, Kan.

Proposed Investigation of Keokuk Hydroelectric Development.—According to the newspapers, Representative Henry T. Rainey, of Carrollton, Ill., will introduce a resolution in the lower house of Congress calling for the appointment of a special committee to investigate the rights, duties and rates of the Mississippi River Power Company, which, as the successor of the Keokuk & Hamilton Water Power Company, built the great hydroelectric plant on the Mississippi River at Keokuk, Ia. "The Keokuk dam," Mr. Rainey is reported to have said, "is not proving the boon to Illinois that was predicted. The plan of procedure seems to involve buying up the lighting and power plants of the cities within range of the transmission lines, then to bring about the dismantling of these plants, and to end in conditions under which electrical energy for all purposes costs more than before. I do not care to name the Illinois cities that are being enthralled in this manner, but I feel sure an investigation would bring to light a dozen such cases. I am prepared to specify a few myself."

Electrical Export Opportunities.—In parts of Spain the rates for electric service seem very well fitted to an extension of trade in electrical appliances of various kinds. In Valencia there are four competing companies and, as a result of their fight for business, rates have gone as low as 1.8 cents per kw-hr., or even 0.54 cent in certain cases. Only one of these companies supplies direct current, the others furnishing alternating current of 50 cycles at voltages of 110, 150, 210, 260 and 500. Electricity is being increasingly used in the manufacturing industries in Valencia, and motors of from 2-hp to 5-hp rating are finding a large sale in the same vicinity for pumping purposes. While motors of American make have had some sale in the district, there seems so far to be little of the accessory and appliance business coming to this country. Turkey, while in the past and at present a poor field for electric sales, gives promise of a decided awakening in the near future. Three companies are now engaged in preparations for supplying electric light, telephone and street-railway service in Constantinople, and when these projects get a good footing there should be a rapid growth along electrical lines. An estimate of the number of electrical ranges sold in the United Kingdom annually places the figure at between 700 and 1000. Most of the electrical companies there are municipally operated and lack the authority to deal in appliances of this nature, which explains in part the small sale they enjoy. Such ranges as are sold are generally supplied directly to the user by the manufacturer, through branch stores or through retailers.

NEW YORK METAL MARKET PRICES

	Dec. 8		Dec. 16	
Copper:	Bid.	Asked.	Bid.	Asked.
Standard, spot*	.....	.....	.....	.....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	65 10 0		65 0 0	
Prime Lake	14.50	to 14.75	14.50	to 14.75
Electrolytic	14.25	to 14.50	14.25	to 14.37½
Casting	14.12½	to 14.25	14.00	to 14.12½
Copper wire base	15.50	to 15.75	15.50	to 15.75
Lead	4.10		4.00	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.25		7.25	
Spelter, spot	5.12½	to 5.25	5.15	to 5.25
Tin, spot	37.50	to 37.75	37.70	to 37.95
Aluminum:				
Prompt delivery	19.00	.....	18.75	to 19.00
Future	18.50	to 19.00	18.50	to 19.00

***OLD METALS**

Heavy copper and wire	13.50	13.50
Brass, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	4.05	3.95
Zinc, scrap	4.37½	4.37½

***COPPER EXPORTS**

Total tons to Dec. 16.....15,740

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Electrical Properties to Be Sold by Receiver.—The Consolidated Light & Power Company, with hydroelectric and steam generating properties at Mount Pleasant and Clair, Mich., and a transmission line in the same territory, will be sold at a receiver's sale in Detroit, Mich., on Jan. 13, 1914. At the same time, the Chippewa Construction Company, which has various holdings at Greenville, Mich., and elsewhere in the vicinity, will be sold.

California Utility Seeks to Increase Capital Stock.—A petition has been made to the California Railroad Commission by the Tulare County Power Company, of Lindsay, Cal., for permission to issue $80,000 additional capital stock. The proceeds of the sale of this stock, it is stated, will be applied to the building of an addition to the company's transmission system into the orange district of Tulare County. The present capital stock of the company has a par value of $530,000.

Washington Distributing Company Changes Hands.—The Big Bend Light & Power Company was incorporated in 1908 for the purpose of supplying electric energy for lighting and power service to the towns of Reardon, Davenport, Harrington, Ritzville, Sprague, Paha and Lind, Wash. A distributing business only was done, energy being purchased from the Washington Water Power Company. Word now comes that the former concern has been purchased by the latter, following a recent increase of $5,000,000 in its capital stock, note of which was made in the Nov. 29 issue of the *Electrical World*. The capital stock of the first-mentioned company is $271,000 outstanding, and it has $20,000 first mortgage 6 per cent bonds, also outstanding.

Iowa Utility Plans to Extend Lines.—Application for a franchise has been made by the Iowa Railway & Light Company for a high-tension transmission line between Cedar Rapids and Toledo, Ia., a distance of about 52 miles. This line will be another link in the system of transmission lines which the company purposes to build between Anamosa and Perry, Ia., several sections of which have already been completed. The company has outstanding $1,700,000 of common and $1,154,935 of 7 per cent cumulative preferred stock and $2,937,000 first and refunding mortgage 5 per cent gold bonds. First mortgage 5 per cent gold bonds of the Cedar Rapids & Iowa City Railway & Light Company to the value of $313,000 are also outstanding.

Ohio Utility to Increase Common Stock.—The Public Utilities Commission of Ohio has granted the petition of the Greenville (Ohio) Electric Light & Power Company for authority to issue $30,000 of new common stock, to be sold at not less than par. The proceeds of this sale are to be used for purchasing the material and for defraying construction expenses for a transmission line from Greenville to Union City, Ohio, and for extending the boiler capacity of the company's steam-power plant at the former city. The transmission line will be about 9½ miles in length, and the steam equipment to be installed will consist of two 300-hp Stirling boilers. A 125-ft. stack is also to be built, in connection with the installation of the new boilers.

Capital Stock Increases of Illinois Utility Companies.—Owing to the fact that the State Public Utilities Commission of Illinois will have general supervision of all public utilities in that State after Jan. 1, 1914, a number of utility corporations have been getting their financial houses in order under the law as now existing in anticipation of the change. A statement issued from the office of the Secretary of State at Springfield on Dec. 15 declares that within the last four months upward of $200,000 in fees has been paid into the office, representing a possible increase in the capitalization of public utilities of about $200,000,000. This increase in capitalization, however, is more apparent than real, as in the case of the merger of the Commonwealth Edison Company and the Cosmopolitan Electric Company of Chicago a fee was required on the joint capitalization of the two companies just as if the capitalization had been newly created, which was not the case. The smaller utility companies throughout the State are reported to be giving little attention, apparently, to the new law, but the larger companies have been studying the statute with care.

Utah Power & Light Company Purchases Electrical Property.—The Utah Power & Light Company is understood to have acquired the entire capital stock of the San Juan Water & Power Company, with a par value of $1,000,000, together with the outstanding $1,350,000 first mortgage 5 per cent gold bonds. While the San Juan Water & Power Company has been virtually under the same control since its incorporation in 1909, as a reorganization of the Animas Power & Water Company, this control was exercised through a majority interest in its stock and securities, rather than by outright ownership. The Utah Power & Light Company was organized in 1912 as the operating company in Utah and Idaho of the Utah Securities Corporation, which company controls it through stock ownership.

Dean Electric Company Reorganization.—The Dean Electric Company, of Elyria, Ohio, manufacturer of telephone apparatus and other electrical supplies, is in process of reorganization, and a committee representing the bondholders and other creditors of the concern has been formed to co-operate with the management in this work. E. F. Allen, J. M. Lenz and A. B. Garford will represent the bondholders, the merchandise creditors, and the banking creditors, respectively, on this committee. A statement by A. G. Bean, president of the company, assures co-operation between this committee and the management and contains the information that manufacturing will continue uninterrupted. The company has a capital stock of $1,655,000, with outstanding bonds of $50,000 par value, and a floating debt of over $300,000.

Toledo Railways & Light Adds to Generating Capacity.—On Dec. 14, eighteen days after its arrival at Toledo, the new 12,500-kw turbo-generating unit of the Toledo (Ohio) Railway & Light Company was placed in operation. This unit represents about 60 per cent increase in the generating capacity of the Toledo station and has been made necessary by a power demand largely in excess of the capacity of the station previous to its installation. In connection with this new unit the boiler capacity of the plant has been increased 15,000 hp. The company now has about 1200 motor-service customers, with over 3000 motors in operation, and both figures are rapidly increasing. The lack of adequate generating capacity has greatly retarded growth along these lines in the past year, but with the new unit in operation it is expected that many new power contracts will be obtained.

Standing Committees of the Investment Bankers' Association.—Announcement has been made by G. B. Caldwell, president of the Investment Bankers' Association, concerning the personnel of the standing committees of that organization for the coming year. The following appointments have been made of chairmen of the various committees: Constitution and by-laws, E. M. Stevens; finance and auditing, J. H. Smith; foreign relations, E. W. Bulkley; irrigation, reclamation and agricultural credits, A. C. Foster; legislation, A. G. Hoyt; membership, J. E. Blunt, Jr.; monetary legislation, John Perrin; municipal bonds, C. W. McNear; program for annual meeting, G. W. Kendrick, 3d; publicity, Lawrence Chamberlain; public service corporations, J. E. Oldham; railroad bonds and equipment notes, S. L. Fuller; taxation, F. W. Rollins, and timber bonds, Calvin Feutress.

Pennsylvania Electrical Property Purchased.—The National Properties Company, of Pittsburgh, Pa., has recently purchased the Chester County Light Company, which has a capital stock of $50,000, together with $25,000 first mortgage and $50,000 second mortgage bonds outstanding. The latter company has a perpetual franchise in Newcastle County, Del., and a transmission line from Newark, Del., to Avondale, Pa. It has also water-power rights at Rosemont and Tweedville, Del., where a hydroelectric generating station is in operation at the present time. The Chester County Electric Company is also controlled by the same concern. Electric light and power are supplied by the Chester County Light Company to numerous small towns in the southeastern part of Pennsylvania. Transmission lines now building will connect these communities with the large central station of the Wilmington & Philadelphia Traction Company at Wilmington, Del., which company came under the control of the National Properties Company early in 1913 through the purchase of a large block of common stock.

Business Notes

The Chicago Fuse Manufacturing Company makes the announcement that after Dec. 15 its city trade in Chicago will be handled by W. O. Roach, who takes the place of W. E. Finlay, resigned.

The Wagner Electric Manufacturing Company, of St. Louis, Mo., has recently appointed T. T. Richards assistant manager. Mr. Richards has been associated with the company in its sales department for the past nine years, specializing in the marketing of new devices.

The Alberger Pump & Condenser Company, of 90 West Street, New York, has recently appointed T. S. Fuller as its secretary and treasurer, vice W. R. Billings, resigned. Mr. Fuller was formerly connected with the Scranton Bolt & Nut Company and was treasurer of Milliken Brothers.

The Pittsburgh High-Voltage Insulator Company, of Derry, Pa., has recently obtained the services of J. W. Blankenhorn for its electrical engineering department. Mr. Blankenhorn has been connected for some time with the engineering department of the Stone & Webster Engineering Corporation, of Boston, Mass.

The Sterling Varnish Company, of Pittsburgh, Pa., has secured the services of J. H. Shugg as insulation engineer. Mr. Shugg was until recently engaged in similar work at the Schenectady works of the General Electric Company, with which concern he has spent nearly a quarter of a century.

Ray D. Lillibridge, Inc., of 111 Broadway, New York, states in a recent communication that rumors to the effect that the New York office and business are to be abandoned in favor of some California interests are without foundation. A branch office is, however, to be opened in San Francisco during 1914 to take care of the interests of clients who will exhibit at the Panama Pacific Exposition in 1915.

Menominee Electric Manufacturing Company.—Mr. L. M. Wood, purchasing agent for the Wesco Supply Company, of St. Louis, has resigned his position with that company, and after Jan. 1 he will be sales manager for the Menominee (Mich.) Electric Manufacturing Company. Mr. Wood worked himself up from the position of counter boy in the Wesco company, and he is one of the most popular of the younger electrical business men of St. Louis. He is a Jovian.

The Collins-Wagner Company has recently been organized with headquarters at 244 West Twenty-ninth Street, New York, for the purpose of manufacturing and selling electric and gas lighting fixtures and other bronze work. Both the manufacturing plant and the showroom of the company will be located at the above address. The president of the company, Charles Wagner, and the vice-president, A. V. Collins, have both been associated previously with companies in this line of work. H. M. Kahle is secretary of the new concern.

New Industrial Companies

Green, Ward & Weber, Inc., of Rochester, N. Y., has been incorporated with a capital stock of $10,000 to do an electrical contracting business. The incorporators are: Ralph D. Ward, Alfred L. Green and J. Fred Weber, all of Rochster.

The Betschel Storage Battery Company, of Chicago, Ill., has been incorporated with a capital stock of $31,000 by R. A. Risch, George M. Merke and H. L. Wuerfel. The company proposes to manufacture and sell electric batteries, electrical novelties, etc.

The Ionex Electrical Development Company, of Chicago, Ill., has been incorporated with a capital stock of $2,500 to manufacture and deal in electrical and mechanical machinery. The incorporators are Luther Johns, Irving S. Kemp and Edgar F. Beaubien.

The Ingersoll Electric Vaporizer Company, of Chicago, Ill., has been incorporated by Homer H. Ingersoll, Theobold Mueller and Daniel Mueller. The company is capitalized at $15,000 and proposes to manufacture and deal in machinery, tools, devices, etc.

Trade Publications

Switches.—Catalog E, issued by the New York office of the Hart Manufacturing Company, has been supplemented by a discount sheet and a sheet treating of Diamond "H" wall cases.

Watt-hour Meters.—Alternating-current watt-hour meters are fully described and illustrated in a folder issued by the Westinghouse Electric & Manufacturing Company. Load curves of different types of meters are also shown.

Securities.—A booklet recently issued by W. P. Bonbright & Company, of 14 Wall Street, New York City, gives the latest available statements of some of the public utility properties in whose securities that company is dealing.

Washing Machines.—The Automatic Electric Washer Company, Newton, Ia., has recently issued a catalog illustrating and describing its motor-driven washer. There is a constantly increasing demand for electric washers that makes this catalog interesting and timely.

Generators.—In Bulletin A4151 of the General Electric Company engine-driven continuous-current generators of the commutating-pole type are described. These generators are manufactured in both two-wire and three-wire styles. They range in rating from 25 kw to 400 kw inclusive.

Cable.—The BX cable manufactured by the Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York, is the subject of a leaflet recently issued, in which it is stated that this flexible-steel armored conductor has been in use fourteen years and is "still in the lead."

Miner's Safety Lamp.—The Edison Storage Battery Company, Orange, N. J., is distributing a ten-page pamphlet referring to its electric safety lamps for the conservation of life in mines. It tells in an interesting manner about the development of this lamp and describes the characteristics of the present lamp with the Edison cell.

Pulmotor.—A leaflet issued by the Draeger Oxygen Apparatus Company, 422 First Avenue, Pittsburgh, Pa., gives ten excellent and convincing reasons why the pulmotor should be installed wherever there is need for resuscitation apparatus. The company has also issued a folder referring to its helmets, which are being used successfully by mine workers.

Diesel Engines.—Carels Frères, of Ghent, Belgium, who are represented in the United States by W. R. Haynie, 30 Church Street, New York, have issued a pamphlet describing the Diesel engine supplied by them for driving the tank ship *Wotan*, belonging to the German-American Petroleum Company. This is the highest-powered engine of its type in existence.

Wiring Material.—The H. T. Paiste Company, Philadelphia, Pa., has recently published a 128-page illustrated catalog and price list of Paiste standardized wiring material. Since the publication of its last catalog the company lists in the present publication over 360 new articles added to the Paiste line. The catalog is well arranged and neatly printed. A code-word index, a catalog number index and a general index add to its usefulness.

Line Material.—The Line Material Company, South Milwaukee, Wis., is publishing the *Kyle Line Magazine*, an interesting little publication which in contents and make-up is somewhat different from the familiar house organ. The magazine, which is published monthly, is, as stated in an early issue, "devoted to common honesty, efficiency, humor and things in general," and is edited by Mr. David Gibson. The central double-page advertises the company's line material.

Storage Batteries.—"Twenty-five Years of Storage Battery Building" is the title of an interesting pamphlet lately issued by the Electric Storage Battery Company, of Philadelphia, Pa., on the occasion of its silver anniversary. The attractive cover, done in pearl gray with silver lettering, incloses a history of the company's growth, together with many pictures of its product and properties and photographs of its official staff. A smaller pamphlet just put out by the same concern tells about "boosting," or the auxiliary charging of vehicle batteries for short periods at rates higher than normal.

Personal Mention

Mr. J. H. Betts, New York City, has been appointed statesman-at-large of the Jovian Order.

Mr. M. Stephan, operating manager of the Compagnie des Forges et Acieries Electriques, Ugine, Savoy, France, who was in this country for several weeks on business pertaining to the Girod electric furnace, sailed for Europe on Dec. 13.

Mr. John F. Gilchrist, assistant to the president of the Commonwealth Edison Company, addressed the Chicago Engineers' Club on Dec. 11, giving a history of central-station development in Chicago and pointing out the advantages of concentrating the production of energy.

Mr. John Howatt has been appointed chief engineer of the Board of Education of Chicago. He has been an inspector for the United States Treasury Department in charge of the mechanical and electrical equipment of federal buildings in the Middle West. Of twenty-nine men who took the civil service examination for the position, which pays $6,000 a year, Mr. Howatt's name appeared first, with a percentage of 76.88. Mr. Howatt is thirty-two years old. He took the course in electrical engineering at the University of Minnesota, graduating in 1904 with the degree of E. E.

Mr. E. B. Neiswanger, superintendent of construction of the Texas Power & Light Company, has been appointed construction engineer of the company in charge of all construction, to succeed Mr. G. E. Moffat, chief engineer, who has resigned to accept a similar position with the Phoenix Construction Company. For ten years prior to entering the service of the Texas Power & Light Company in January, 1913, as superintendent of construction, Mr. Neiswanger was engaged in plant installation and efficiency work with mining and milling interests in Colorado, and with beet-sugar and irrigation projects in Kansas.

Mr. Paul P. Bird has resigned from the Commonwealth Edison Company to become a member of the new firm of Norton & Bird, consulting engineers, of Chicago. Mr. Bird was born in Kalamazoo, Mich., but during his boyhood his family removed to Rochester, N. Y., where he attended the Rochester Free Academy. He entered Cornell University in the class of 1900 and graduated with the degree of M.E. For several years thereafter he was employed by the Newport News Ship Building Company, of Newport News, Va., although in an interval of that employment he spent one year as instructor at Cornell. In 1904 Mr. Bird came to Chicago and for three years he was steam engineer for the Illinois Steel Company at the South Chicago works. In the fall of 1907 he was appointed by Mayor Busse chief smoke inspector for Chicago, and he held this position until May, 1911, when he accepted a position with the contract department of the Commonwealth Edison Company. Mr. Bird made an excellent record as head of the department of smoke inspection of the city of Chicago, and his work attracted wide attention. He read papers on the subject of smoke prevention before the Western Society of Engineers, the American Civic Association and other bodies. In 1910 and 1911 he was president of the International Association for the Prevention of Smoke. He is a member of the important committee on investigation of smoke abatement and electrification of railway terminals of the Chicago Association of Commerce. Mr. Bird is a member of the American Society of Mechanical Engineers and chairman of the flourishing Chicago section of that society. He is also a member of the Western Society of Engineers, the National Electric Light Association, the University Club of Chicago and of the Exmoor Country Club.

PAUL P. BIRD

Mr. J. L. Longino has succeeded Mr. M. A. Cohn as superintendent of the lighting department of the Merchants' Lighting Company, Little Rock, Ark.

Mr. W. L. Davis has recently been elected as assistant secretary and assistant treasurer of the Texas Power & Light Company and affiliated companies, including the Paris Transit Company, succeeding Mr. E. E. Reber, resigned. Mr. Davis entered railway service in 1906 with the Indiana, Columbus & Eastern Traction Company, later merged into Ohio Electric Railway Company. After holding various positions in the accounting department of this company, he was appointed statistician in 1909. In August, 1912, he accepted the position of traveling auditor of the Texas Power & Light Company, of which company, with its affiliated companies, he now becomes assistant secretary and assistant treasurer.

Mr. M. C. Gilman has been appointed sales manager of the Toronto Electric Light Company, Ltd., of Toronto, Ontario, Can., vice Mr. W. R. Sweany. Mr. Gilman was graduated from the electrical engineering course at Pratt Institute, Brooklyn, N. Y., in 1907, and since then has had experience in the central-station field as assistant power engineer of the Edison Electric Illuminating Company of Brooklyn, assistant power engineer of the Public Service Electric Company of Newark, power engineer of the Virginia Railway & Power Company of Richmond, Va., and power engineer of the Toronto Electric Light Company. For the past year Mr. Gilman has served as assistant to Mr. F. G. Clark, chief engineer of the Toronto Electric Light Company, Ltd., from which position he is now promoted to that of sales manager.

Mr. William J. Norton has severed his connection with the Commonwealth Edison Company to engage in private practice as a member of the new firm of Norton & Bird, consulting engineers, of Chicago. Mr. Norton is a native of Baltimore and obtained his academic education at Baltimore City College. After a business experience of three years with the Factories Mutual Fire Insurance Companies, he entered Cornell University, class of 1902, and was graduated with the degree of M.E. After leaving college Mr. Norton was connected for a short time with the engineering department of the Chicago Edison Company. Thereafter he was employed successively by the Chicago Ship Building Company and the New York Ship Building Company of Camden, N. J. Later he was vice-president and general manager of the Federal Sign System (Electric), with headquarters in New York. From 1907 to 1911 Mr. Norton was first assistant secretary of the Public Service Commission for the First District of the State of New York. In this position he gained a good insight into the subject of public utility regulation and was impressed with the importance of it. In 1911 he returned to Chicago to assist the Commonwealth Edison Company in the pending rate regulation by the City Council—a work which has just been carried to a successful conclusion. Two years ago Mr. Norton was made secretary of the rate research committee of the National Electric Light Association, a position which he still holds. He is also editor of *Rate Research*, the weekly paper published by the committee. He is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the Society of Naval Architects and Marine Engineers, the American Gas Institute, the Jovian Order and other societies. He also belongs to the Engineers' Club of New York, the University Club of Chicago and the Winnetka Country Club. He has published an annotated edition of the Illinois public utility law and has presented a number of papers before electrical societies on rate-regulation subjects. Perhaps the most interesting of these is "Two Epochs of Rate Regulation," read before the Michigan Section of the National Electric Light Association last summer.

WILLIAM J. NORTON

Mr. E. W. Stevenson, electrical engineer of the Hazard Manufacturing Company of Wilkes-Barre, Pa., has resigned from that company to become sales agent for Messrs. Smith & Nichols, manufacturers of waxes. Mr. Stevenson, who is well known in the electrical industry, has been engaged in almost every branch of the wire and cable business for thirty-four years. He was with the Hazard Manufacturing Company ever since it began the manufacture of insulated wire in 1899. Previous to that he spent four years as electrical engineer with the Okonite Company, and for two years previous to that he acted as consulting engineer. From 1880 to 1886 Mr. Stevenson was in the employ of the Telegraph, Construction & Maintenance Company of London, Eng., and from 1889 to 1904 he was in charge of the underground cable circuits of the old Brush Electric Illuminating Company of New York. Before going with the Brush company he spent two years with the Commercial Cable Company. Mr. Stevenson's close work in the factory fits him well for his new work. He went to England last summer to "try himself out" and made a preliminary expedition three years ago with the same object in view. The firm with which he is now connected is a very old, well-established concern and has supplied the trade with waxes from the very beginning.

E. W. STEVENSON

Obituary

Albert Durkee, one of the oldest employees of the Commonwealth Edison Company, Chicago, died on Nov. 30, aged sixty-five years. He entered the service of the company about twenty-five years ago and was a lighting solicitor in the down-town district, although for the last three years he had been incapacitated by illness. Mr. Durkee was a native of the Province of Nova Scotia, Canada, and in early life was a sailor. He leaves a wife and five adult children.

Daniel M. Barton, general purchasing agent of the General Electric Company, died at his home in Schenectady of heart failure on Dec. 5. Mr. Barton was born in Moriah, N. Y., in 1843. His father, Silas D. Barton, a farmer by occupation, moved his family to Ware, Mass., while his children were still young. It was there that Mr. Barton spent most of his youth up to the age of nineteen, when, together with his brothers, Henry and Silas A., he enlisted in the army. After his return from the war he became a dry goods merchant in Meriden, Conn., following which he removed to Lynn, Mass., where he followed the occupation of bookkeeper and newsdealer. In 1883 the Thomson-Houston Electric Company was formed by citizens of Lynn, one of the leading spirits among them being Silas A. Barton, and the company was established in Lynn. Three years later Mr. Barton entered the employ of that company and became its first production manager, under Mr. E. W. Rice, Jr., then superintendent. During his administration of this office and inspired by the first large railway contract secured by the company for electrifying the West End Street Railway Company, Boston, he devised and inaugurated some novel and successful systems of scheduling, regulating and expediting production, which attracted wide attention. In 1893 Mr. Barton became assistant purchasing agent of the General Electric Company, which had been formed the previous year. With the removal of the department to Schenectady, after it was decided early in 1894 to make that city the headquarters of the company, Mr. Barton was appointed purchasing agent, this title being changed to general purchasing agent some years later. This position he filled ably and loyally up to the time of his death. He is survived by his widow, a daughter, and three grandchildren.

Construction

New England

CLARK'S MILL, ME.—The Clark Pwr. Co., of Clark's Mill, has recently completed the erection of 4 miles of transmission line. The company will probably erect more extensions next summer. Cecil F. Clark is president and manager.

BURLINGTON, VT.—The Burlington Trac. Co. will soon install transformers and erect distribution lines for supplying the town of Shelburne with about 30 tungsten street lamps and furnishing electricity for about 30 residences and also the estate of Dr. W. S. Webb with about 100 hp for lamps and motors. Carl B. Brownell is superintendent.

VERGENNES, VT.—The capital stock of the Vergennes El. Co. has been purchased by the Burlington Trac. Co. interests, which will continue to operate the local business under the same name. The old plant, consisting of a 75-kw, 133-cycle, 1,100-volt generator and a 20-lamp Thomson-Houston direct-current arc machine, will be dismantled and the lines connected with the lines of the Burlington Trac. Co.'s plant (1400-kva, 60-cycle, 2400-volt). This change will require many new transformers and a series tungsten street-lighting system.

Middle Atlantic

ARCADE, N. Y.—The village of Arcade is installing a coal conveyor at the municipal electric-light plant. J. H. Howard is village clerk.

BUFFALO, N. Y.—Bids will be received by Francis G. Ward, commissioner of public works, Room 5, Municipal Building, Buffalo, N. Y., until Dec. 26, for furnishing labor and material required for the construction of a new 16-room fireproof school building on Oak Street, near Genesee, in accordance with plans and specifications prepared by George J. Metzger, architect, as follows: (A) Masonry, etc.; (B) structural iron and steel work, etc.; (C) fireproofing, floors, etc.; (D) carpentry work, painting, etc.; (E) roofing, sheet-metal work, etc.; (F) electrical work, telephone system, lighting fixtures, etc.; (G) heating, ventilating, radiation, etc.; (H) plumbing, drainage, gas-fitting, etc. A separate and distinct proposal must be made for each division of the work.

HANNAWA FALLS, N. Y.—The Hannawa Falls Wtr. Pwr. Co. has applied to the Public Service Commission, Second District, for permission to increase its capital stock from $300,000 to $600,000. The company has also petitioned for authority to issue its first and refunding collateral trust mortgage to the amount of $1,200,000 and to issue bonds to the amount of $800,000 to acquire and hold 1380 shares of the capital stock of the Northern Pwr. Co., of Potsdam.

ST. REGIS FALLS, N. Y.—The St. Regis Falls Lt. & Pwr. Co. is contemplating placing its wires underground next season. If the project is carried out, steel-taped cable will be used.

SYRACUSE, N. Y.—Plans for the concentration of all water-power interests along the Oswego River, it is reported, are completed. The plan provides for a central electric power plant, which will furnish sufficient electricity to operate factories which are now depending upon waterwheels for power. The project will be capitalized for more than $2,500,000. The Fulton Lt., Ht. & Pwr. Co., of Fulton, is interested in the above project.

ASHLAND, PA.—The Schuylkill Lt., Ht. & Pwr. Co., of Centralia, has applied to the Public Service Commission for permission to engage in business in Ashland. An ordinance is now awaiting action by the Ashland Council granting the Schuylkill company a franchise here.

BANGOR, PA.—Application has been made to the Town Council by the Industrial El. Co. to furnish electrical service in Bangor. The company proposes to use the poles of the Blue Mountain Tel. Co. to carry its wires. A substation will be erected by the Lehigh Navigation & El. Co., from which energy will be purchased, outside of Bangor.

BRADDOCK, PA.—Bids will be received by the Board of Education, addressed to S. D. Hamilton, secretary, until Jan. 5 for the construction of a high school building for which separate bids are to be submitted as follows: General contract construction; heating and ventilating plant; water supply equipment; plumbing and gas fitting; electric-light and power equipment, and telephone installation and vacuum-cleaning apparatus. Plans and specifications, bidding blanks and full information can be secured at the office of Carlisle & Sharrer, architects, 7119 Jenkins Arcade, Pittsburgh, Pa.

ELLWOOD CITY, PA.—The City Council has awarded the Harmony Co. a contract for furnishing the city electricity for lighting purposes for a period of ten years.

PHILADELPHIA, PA.—Bids will be received at the office of the commanding officer, Frankford Arsenal, Philadelphia, Pa., until Dec. 29, for the installation of one steam turbine generator, with exciter and switchboard, and one condensing equipment in the engine room of the power plant at the Frankford Arsenal, Philadelphia.

PHILADELPHIA, PA.—Bids will be received by M. L. Cooke, director of Department of Public Works, Room 332, City Hall, Philadelphia, until Dec. 22, for furnishing and maintaining lamps for lighting the streets, parks, bridges and public places in the city of Philadelphia. Blank forms and specifications may be obtained at the office of Bureau of Lighting, Room 332, City Hall, Philadelphia.

PHILADELPHIA, PA.—Bids will be received at the office of the Department of Health and Charities, 584 City Hall, Philadelphia, until Dec. 26, for the construction of a power plant for the Philadelphia Institution for Feeble-Minded at Byberry. Plans, specifications, form of proposal and other information may be obtained upon application to Philip H. Johnson, architect, 1824 Land Title Building, Philadelphia. Joseph S. Neff, M.D., is director.

PITTSBURGH, PA.—The City Council has authorized the director of public works to install an ornamental street-lighting system in Grandview Avenue from Wyoming Street to Republic Street.

BEDFORD CITY, VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 26, for construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Bedford City. Drawings and specifications may be obtained at the above office or from the custodian of site at Bedford City. O. Wenderoth is supervising architect.

CLARENDON, VA.—The Board of Supervisors of Alexandria County has awarded the contract for furnishing 100 electric lamps along the main thoroughfares of Alexandria County to M. E. Church, of Falls Church, at $15 per lamp per year.

MONTEREY, VA.—The Monterey Garage & Lt. Co. expects to purchase within the next six months 25 meters. C. W. Lunsford is manager.

WASHINGTON, D. C.—Plans are being prepared by the Treasury Department for the proposed central heating and power plant for the government buildings, provided for in the last sundry civil act.

WASHINGTON, D. C.—An American consul reports that a foreign government contemplates the development of some of its water-power resources for industrial purposes and possibly for motive power for a light railway. The cost of the work is estimated at about $3,000,000. For further information, address No. 12,105, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Bids will be received by the Secretary of the Interior, Department of the Interior, Washington, D. C., until Jan. 9, 1914, for remodeling power plant of the Government Hospital for the Insane, Anacostia, D. C., in accordance with plans and specifications, copies of which may be obtained on application to the chief clerk of the department. Bidders are to take part payment in the old machinery now in operation. Lewis C. Laylin is assistant secretary.

North Central

DECKERVILLE, MICH.—The power plant of the Deckerville El. Lt. & Wtr. Co. was damaged by an explosion of pressure tank on Dec. 9, causing a loss of about $3,000.

DURAND, MICH.—Within the next six months the Water and Light Commission expects to install a 125-kva direct-connected unit, consisting of a three-phase, 1100/2000-volt generator with simple engine (automatic Corliss type). H. F. Rosenkrans is superintendent.

FREMONT, MICH.—A company is being organized by local citizens for the purpose of furnishing electricity in Fremont. The new company will take over the Walter Snow dam sites on Cushman Creek and White River for the purpose of building dams and a power house. The new corporation will have an authorized capital stock of $75,000.

JONESVILLE, MICH.—The Water and Light Department is installing a new 78-in. by 18-in Wicks tubular boiler in the municipal power plant. George T. Caldwell is superintendent.

WAKEFIELD, MICH.—The proposal to issue $5,000 in bonds for the purchase of electrical equipment will be submitted to the voters.

BELLAIRE, OHIO.—Bids will be received at office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 19, for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Bellaire. Drawings and specifications may be obtained at the above office or from the custodian of site at Bellaire. O. Wenderoth is supervising architect.

BELLEFONTAINE, OHIO.—The City Council is considering the question of authorizing an issue of $36,000 in bonds, the proceeds to be used for improvements and extensions to the municipal electric-light plant.

CANTON, OHIO.—The installation of a municipal electric-light plant is under consideration. Mayor Turnbull proposes to ask the City Council to call an election to vote on the question of issuing bonds for same.

CANTON, OHIO.—The Federal Clay Products Co. is planning to expend between $60,000 and $100,000 for the construction of a new building to replace the building destroyed by fire some time ago, and for the centralization of its power system. The company has four plants in operation, and under the present system power for each is furnished separately. It is proposed to install a new 1000-hp plant to furnish power for all the buildings.

CLEVELAND, OHIO.—The Cleveland El. Illg. Co. has been granted permission to erect a power house at 2260 Canal Road, four stories high, to cost about $6,000.

CLEVELAND, OHIO.—Bids will be received at the office of W. H. Kirby, secretary to the director of public service, 204 City Hall, Cleve-

land, until Dec. 30, for steam turbine-driven exciter set for the municipal electric-light plant, in accordance with plans and specifications, which may be obtained in the office of the engineer of construction, Room 419, City Hall. W. J. Springborn is director of public service.

COLUMBUS, OHIO.—The report of Harry R. Allensworth, electrical engineer, estimates the cost of placing the overhead wires owned by the municipality in underground conduits in the downtown district at $25,000. Arrangements are also being made by the local utilities companies to begin work on placing their wires in underground conduits.

GREENVILLE, OHIO.—The Public Utilities Commission has authorized the Greenville El. Lt. & Pwr. Co. to issue $30,000 in capital stock, the proceeds to be used for the purchase of material and erection of a transmission line from Greenville to Union City, a distance of 9½ miles; also for the purchase and installation of two 300-hp Stirling boilers in the Greenville power station and for a 125-ft. radial brick stack.

MECHANICSBURG, OHIO.—The Mechanicsburg Lt. & Pwr. Co. expects to purchase within the next month some electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. T. J. Long is general manager.

YOUNGSTOWN, OHIO.—The Public Utilities Commission has authorized the Mahoning County Lt. Co., of Youngstown, to sell $10,000 in common stock, the proceeds to be used to begin the equipment of an electric-light plant. The proposed plant will be situated at the foot of Hazel Street and when completed will cost more than $100,000. The company was recently granted a franchise to furnish electrical service in Youngstown. Paul Kaercher, of the Youngstown Steel Htg. Co., is interested in the Mahoning company.

BURNSIDE, KY.—The Kentucky Utilities Co., of Burnside, has recently finished the erection of a transmission line from Somerset to Burnside, a distance of 8 miles. J. W. Sloan is district manager.

MOUNT VERNON, KY.—The Mount Vernon El. Lt. & Ice Co., recently incorporated, is planning to install an electric-light plant and ice factory in the near future. U. G. Baker is president of the company and James Maret is secretary.

MENTONE, IND.—The Board of Trustees has granted a franchise to William P. Hollands and William C. Davis, of Mentone, owners of the local electric-light plant, to erect transmission lines for the distribution of electricity in Mentone for a period of ten years.

BUNKER HILL, ILL.—The electric light committee may purchase some meters and a few lightning arresters. Harry McPherson is chairman of the electric light committee.

CANTON, ILL.—The capital stock of the Canton Gas & El. Co. has been increased from $100,000 to $500,000.

CHICAGO, ILL.—Bids will be received by Ray Palmer, city electrician, Room 614, City Hall, Chicago, until Dec. 22, for furnishing the Department of Electricity with arc-lamp carbons for electric lamps, in accordance with specifications on file in the above office, as follows: 200,000 14-in. by 5/32-in. copper-coated carbons; 125,000 12-in. by 0.510-in. to 0.520 in. solid, high-grade carbons; 125,000 12-in. by 0.510-in. to 0.520-in. cored, high-grade carbons; 530,000 12-in. by 7/64 in. white-flame carbons for General Electric-Lynn arc lamps; 12,000 pairs white-flame carbons for Stave arc lamps, upper carbon dimensions 10¼-in. by 20 mm, lower carbon dimensions 8¾ in. by 18 mm. Proposals must be made out on blanks furnished by the city electrician.

CHICAGO, ILL.—Sealed proposals will be received by Ray Palmer, city electrician, Room 614, City Hall, Chicago, Ill., until Dec. 23, for furnishing the Department of Electricity sundry kinds and sizes of incandescent and tungsten lamps for the year 1914, in accordance with specifications on file in the above office, as follows: 6000 25-watt, 115-volt, tungsten, drawn-wire filament lamps; 25,000 80-watt, 4-amp series tungsten lamps; also lamps of such other watage as may be required from time to time during the year by the various departments of the city of Chicago. Bids will also be received at the same time and place for 1,025 dozen outer globes for arc lamps, 900 dozen inner globes, heat-resisting, for arc lamps. Specifications are on file in the above office. Proposals must be made out on blanks furnished by the city electrician.

NAUVOO, ILL.—Within the next six months the Nauvoo El. Lt. & Pwr. Co. expects to purchase some auxiliary and switching equipment, also transformers, poles, lightning arresters, wire and meters, and electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc. Joseph Nelson is manager.

OGLESBY, ILL.—The City Council has decided to abandon the local plant and secure electricity from the Citizens' Ltg. Co., of La Salle. Under the terms of the contract the city of Oglesby is to erect the transmission line from Jonesville to this city.

GLENWOOD, WIS.—The Glenwood & Downing Lt. & Pwr. Co., of Glenwood, expects to purchase a 60-kw, 60-cycle generator to replace a 133-cycle machine. No definite action has been taken on the matter. The company has recently changed the Downing line from 1,100 volts to 2,200 volts.

GRAND RAPIDS, WIS.—Last April the city voted to purchase the plant of the Grand Rapids El. Co. An appraisal of the system is now being made by the State Railroad Commission. The street-lighting apparatus is loaded to the limit. Additions to this part of the system will be necessary in the spring. M. N. Weeks is manager.

GREENBUSH, WIS.—It is reported that Otto Herring is contemplating the construction of a concrete dam and the installation of an electric-light plant to furnish electricity for lamps in Greenbush.

LA CROSSE WIS.—A committee, consisting of Aldermen Roellig, Strauss and Worth, has been appointed by Mayor Ori J. Sorensen to investigate the advisability of establishing a municipal lighting plant.

WEST BEND, WIS.—Within the next eight months the West Bend Htg. & Ltg. Co. expects to purchase boilers and turbines and some poles. G. W. Kuehltham is president.

CLARA CITY, MINN.—A committee, consisting of M. S. Carl and E. Thien, has been appointed by the Commercial Club to investigate the matter of establishing a municipal electric-light plant.

FARMINGTON, MINN.—Within the next three months the Farmington El. Lt. & Pwr. Co. expects to erect a 55-hp producer gas engine and a gas producer of 150 hp; also a 250-volt generator and balancer set, or three-wire generator, switchboard and auxiliaries for above, and about 2 miles of transmission lines, and also to enlarge its feeders. The company recently installed a 240-amp-hr. National battery with switchboard and booster. F. H. Eddy is manager.

KERKHOVEN, MINN.—The City Council has entered into an agreement with the Kerkhoven Roller Mill Co. whereby the latter will install an electric light and power plant and furnish the city with electricity for lamps.

LYLE, MINN.—N. T. Fontun, manager of the local electric-light plant, expects to erect a new power-house and to purchase a crude-oil engine and second-hand motors and dynamo (1,100-volt, 133 cycles, three-phase) within the next year; also within the next two months to purchase some lamps.

TWO HARBORS, MINN.—The City Council expects to purchase within the next 30 days one combination anthracite and bituminous coal wagon loader and one 5 hp, 60-cycle, single-phase motor with drum for pulling coal cart. Aug. Omtvedt is city clerk.

BLOOMFIELD, IA.—The City Council and Commercial Club are considering a proposal submitted by the Centerville El. Lt. & Trac. Co., of Centerville, to furnish electricity for lamps and motors in Bloomfield.

DENNISON, IA.—The contract for installing electric equipment in the new opera house has been awarded to the James G. Bradley El. Co., of Council Bluffs.

KEOTA, IA.—The local electric-light plant has been purchased by Walsh Brothers, of Burlington. It is understood that improvements will be made to the system.

NORA SPRINGS, IA.—O. E. Jacobson, owner of the local electric-light plant, expects to make some additions to its plant during the coming year.

ROCKWELL CITY, IA.—The local electric-light plant was destroyed by fire on Dec. 2, causing a loss of about $10,000.

SHELBY, IA.—The citizens on Dec. 1 voted to grant the Avoca El. Lt. & Pwr. Co., of Avoca, a 20-year franchise to furnish electricity in Shelby. W. A. Torrey, of Avoca, is engineer in charge.

WESTGATE, IA.—It is reported that Tegmeier Brothers have closed a contract for a large engine and generator, which will be installed in their garage. They propose to furnish electricity for lamps and motors in Westgate.

CLARENCE, MO.—The city of Clarence is considering the question of installing a directly connected unit next summer, details not yet decided upon. D. McIntire is superintendent.

FULTON, MO.—The board of managers of the Missouri School for the Deaf has decided to complete the new power plant at the institution, at a cost of $9,000. Bids for the work, it is understood, will be received in January. Several new boilers and other equipment will be required.

HAMILTON, MO.—At an election held Dec. 1 the citizens voted to grant a franchise to Messrs. Miller and Gilbert, of Kansas City, Mo., to install and operate an electric-light and power plant and an electric suburban railway and terminals.

BIG STONE CITY, S. D.—Local business men, it is reported, are organizing a stock company to install and operate an electric-lighting system in Big Stone City. M. A. Benjamin is interested in the project.

MITCHELL, S. D.—The Mitchell Pwr. Co. has just completed the installation of a 225-hp Diesel engine and a 200-kw Fort Wayne generator.

ALLIANCE, NEB.—The Electric Light Commission expects to purchase within the next six months a few transformers (pole type), a carload of 25-ft. and 30-ft. poles and a small line of household electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. Clare A. Dow is superintendent.

FRIEND, NEB.—The village of Friend expects to erect an addition to the power-house of the municipal electric-light plant and water-works system within the next six months; also to purchase a small Corliss engine and an alternating-current generator (belt-driven) and would like to receive catalogs and prices on engine and generators. L. S. Frantz is superintendent.

MEAD, NEB.—The town of Mead contemplates the installation of a municipal electric-light plant, the equipment to consist of a 25-hp oil engine and a 17½-kw generator. The plans for street-lighting system provide for five arc lamps of 250 cp and 10 incandescent lamps of 60 cp; about 1½ miles of transmission lines will be erected. Bids for construction of proposed plant will be called about Feb. 1, 1914. Bruce & Standevan, of Omaha, are designing engineers.

ORD, NEB.—Plans are being prepared for an electric-light plant and for improvements to water-works, to cost approximately $23,000. Bruce & Standevin, Bee Building, Omaha, are engineers. J. C. Work is Mayor.

HOLYROOD, KAN.—The installation of an electric-lighting system is being considered by the City Council. The question will probably be submitted to the voters.

SEVERANCE, KAN.—Plans, it is reported, are being prepared by C. I. Stocking, of Hiawatha, engineer, for an electric-light plant in Severance.

Southern States

SPENCER, N. C.—The city of Spencer is contemplating the installation of a municipal electric-light plant, for which bonds have been issued and sold. Electricity for operating the system will probably be purchased from some power company. D. Fulk is city clerk.

WALLACE, N. C.—Within the next few months the Duplin Lt. & Pwr. Co., of Wallace, expects to purchase a complete generating outfit. J. W. Boney is general manager.

WASHINGTON, N. C.—An appropriation of $20,000 has been made for improvements to the municipal electric-light plant. Gilbert C. White, of Charlotte, N. C., is consulting engineer.

WILMINGTON, N. C.—Within the next six months the Tidewater Pwr. Co., of Wilmington, expects to erect about 6 miles of distribution lines and to purchase the usual amount of material for distribution system, including transformers, poles, lightning arresters, insulators, wires and meters; also within the next 12 months heating and cooking apparatus to the amount of about $1,000 and other electrical devices in proportion. Raymond Hunt is superintendent of electrical department.

OCALA, FLA.—J. D. Robertson, it is reported, contemplates the construction of a hydroelectric plant at Stokes Ferry on Withlacoochee River, to cost approximately $300,000.

LIVINGSTON, TENN.—The Mayor and Board of Aldermen have adopted an ordinance granting a franchise to the Livingston El. Lt. & Pwr. Co. to install and operate an electric-light plant in Livingston. An ordinance is also pending before the board granting a franchise to the T., K. & N. Railroad to use the streets of the city upon which to operate a motor car, which, it is understood, will soon be in operation upon the railroad between Livingston and Algood.

SEQUATCHIE, TENN.—A company is being organized by E. G. Wright to build a hosiery mill. The present plans provide for equipping the proposed mill for electrical operation.

BREWTON, ALA.—Within the next 30 days the city of Brewton expects to purchase one 150-kw generator, one four-valve engine, directly connected to generator, one 175-hp boiler and one electrically-operated pump; also one series street-lighting system complete. D. B. Hayes is city clerk.

GADSDEN, ALA.—The Alabama Pwr. Co. has entered into a contract with the Alabama City, Gadsden & Attalla Ry. Co. (which owns and operates the street railway and electric-lighting plants in Gadsden and the street railway lines in Attalla and Alabama City) to furnish all electricity for lamps and motors in Gadsden for a period of ten years.

UNIONTOWN, ALA.—Within the next three months the managers of the municipal light and water plant expect to install one electrically-operated air compressor. George B. Foss is superintendent.

CHELSEA, OKLA.—Arrangements are being made by the town of Chelsea for the installation of a municipal electric-light plant. Equipment for the plant has already been ordered.

STILLWATER, OKLA.—The city of Stillwater expects to rebuild within the next six months 5 miles of transmission line, which will include about five 10-kw transformers. Within the next 12 months the city expects to purchase one 150-kva, three-phase, 60-cycle (engine-type) generator, with engine and switchboard; also to install additional street lamps, part multiple, part series, all maintained by conduits, using three-lamp ornamental posts. M. W. J. Holt is commissioner of water, light and sewers.

CHANDLER, TEX.—Dabney White, who recently purchased the cotton gin of the Birdwell Brothers, will install an electric-light plant in connection with the cotton gin.

HOLLAND, TEX.—The installation of a municipal electric-light plant in Holland is under consideration.

Pacific States

CENTRALIA, WASH.—The City Council has instructed the city engineer to prepare plans and estimates of cost for extending the lighting service to the districts lying beyond the improved section of the city known as West Main Street.

EATONVILLE, WASH.—All bids for the erection of a transmission line from the Tacoma municipal power plant at Nisqually to Eatonville have been rejected. The line will probably be built by force account. The city has decided to purchase electricity from the Tacoma plant rather than to build a municipal plant.

ELMA, WASH.—The Elma Lt. & Pwr. Co. is contemplating making extensions and improvements to its plant about the first of the year.

RAYMOND, WASH.—Plans are being prepared by the Willapa El. Co. for the construction of a 1000-hp plant, which will be built adjoining the plant of the Willapa Lumber Co. Provision will be made for doubling the output of the plant when necessary.

SEATTLE, WASH.—The Port of Seattle Commission has awarded the contract for furnishing electricity for all port projects now in operation for the ensuing year to the Seattle municipal electric-light plant.

SEATTLE, WASH.—The County Commissioners have granted the Puget Sound Trac., Lt. & Pwr. Co., Seattle, a franchise covering portions of Lake Forest Park and Echo Lake Garden Tracts for a high-tension transmission line.

SEATTLE, WASH.—According to estimates submitted to the City Council by J. D. Ross, superintendent of lighting, the cost of complete development of the Cedar River project to develop 45,000 kw will be, in addition to the amount already expended, $3,320,000. The work includes completion of masonry dam now under construction to an elevation of 1,555 ft., adding 14,000 kw to the present output of the plant; also enlargement of the dam to an elevation of 1,590 ft., the construction of a surge tank, a new penstock, construction of a tunnel and the installation of additional machinery for generating electricity and other purposes. The cost of the full development of the Lake Cushman project to a capacity of 70,000 hp on a 12-hour load-factor, exclusive of land and water rights, is estimated at $5,063,000.

SHELTON, WASH.—The Shelton El. Co. expects to change the present flat-rate system to the meter system, and is also talking of installing a new street-lighting system. W. H. Hollenbeck is manager.

EUGENE, ORE.—Plans for the immediate development of a hydroelectric power project at Clear Dale at the headwaters of the McKenzie River, 90 miles from Eugene, to cost about $5,000,000, by the Oregon El. Ry. Co. have been announced. Work on the construction of the first two units will begin in June. Present plans provide for a development of 45,000 hp. George S. Edmonstone, of Portland, is hydraulic engineer of the Oregon El. Ry. Co.

NORTH BEND, ORE.—Wiliam Schrock, of North Bend, is contemplating the installation of a small electric plant.

REEDSPORT, ORE.—The Department of Agriculture at Washington, D. C., has granted a permit to James Lindsay, of Portland, Ore., to construct a power plant on Mill Creek, in Douglas County, within the Suislaw Forest Reserve. Mr. Lindsay proposes to transmit electricity from the plant to Reedsport, a distance of 18 miles, to operate the pulp mills here.

ALAMEDA, CAL.—The new municipal power station has recently been completed and new machinery installed, including a 1250-kw Parsons turbine with surface condensers and auxiliaries; also two 300-hp Stirling boilers with all fireroom equipment, new feed pumps, closed heater, etc.; a switchboard with high-tension wires in compartment above the ground floor; Bell circuit arrangement for operating switches and 14 voltage feeder regulators on all outgoing feeders. Joseph B. Kahn is superintendent of the Department of Electricity.

ALVISO, CAL.—Bids will be received by the clerk of the Board of Trustees until Jan. 5, 1914, for a franchise to erect transmission lines for the distribution of electricity in the town of Alviso, application for which has been made by the Pacific Gas & El. Co., of San Francisco. S. J. Maggini is clerk.

CLOVERDALE, CAL.—The State Railroad Commission has granted the California Tel. & Lt. Co., of Cloverdale, permission to issue $100,000 in bonds and $50,000 in capital stock, the proceeds to be used for new construction and equipment and refunding indebtedness.

LINDSAY, CAL.—The Tulare County Pwr. Co., of Lindsay, has applied to the California Railroad Commission for permission to issue $80,000 in capital stock, the proceeds to be used for the erection of additional transmission lines into the orange belt of Tulare County.

LOS ANGELES, CAL.—Financial arrangements, it is reported, are being made by the Pacific Lt. & Pwr. Corpn., of Los Angeles, for large extensions to its system in Fresno County. It is understood that the company proposes to increase the height of its dam so as to double the capacity of the lake, to increase the number of units in its No. 1 and 2 power houses, and to construct two more power houses, making the No. 3 plant larger than either of the present plants. The general plan provides for increasing the height of the present dam between 50 ft. and 60 ft., which will double the capacity of the lake now in existence. The number of units to be added to power houses No. 1 and 2 is not known; power house No. 2 will be located near Stevenson Creek. The water will be taken from the San Joaquin River near Mammoth Pool and will be diverted to the power house through a cement conduit about 8 miles long. The No. 4 power plant will be situated near the mouth of Big Sandy. The water will be taken up below the power house No. 3 at Italian Bar and will be diverted across Patterson Bend and delivered back to the river near the mouth of the Big Sandy.

MONTAGUE, CAL.—Congress will be asked by the Shasta Valley Irrigation Association to make an appropriation of $5,000,000 for carrying out a project to irrigate 100,000 acres in 12 townships north, south and east of Montague by means of a canal to bring 40,000 miners' inches of water from the Klamath River at Keno, 36 miles distant. The intake of the proposed canal is 1400 ft. above the floor of the valley and will make possible the development of 40,000 hp of electricity.

OAKLAND, CAL.—The Great Western Pwr. Co. has applied to the State Railroad Commission for a certificate of convenience and necessity to distribute electricity in the city of Oakland. The company heretofore has been distributing electricity under franchises granted in 1909 in a portion of Oakland. It now seeks for permission to extend its distribution lines throughout the entire city.

SUSANVILLE, CAL.—The Lassen El. Co., of Susanville, has been granted a franchise by the Board of Supervisors of Lassen County to erect and operate electric transmission lines in the county of Lassen. George B. Fassett is clerk.

ST. GEORGE, UTAH.—The managers of the municipal electric-light plant expect to purchase in the near future one waterwheel and a high-pressure governor, one 5-kw, 5,500/220/110-volt transformer and twelve 5-amp wattmeters. A new penstock (800 ft. 12-in. spiral-riveted steel) is now being installed. Milo Kemp is manager.

DILLON, MONT.—The Union El. Co., of Dillon, Mont., has recently purchased two waterwheels of the James Leffell Co., of Springfield, Ohio, which will be installed during December. L. K. Adams is vice-president and manager.

ALAMOSA, COL.—Within the next six months the Mutual El. Lt. & Pwr. Co., of Alamosa, expects to purchase two carloads of poles, 8 miles of wire and a tub transformer, to rearrange its street-lighting contract, if the company secures a new contract from the city. H. A. Goodridge is manager.

LOVELAND, COL.—The Council has engaged a consulting engineer to make investigations and submit estimates of the cost of installing a municipal electric-light plant. The city already owns a site on the Big Thompson River.

STEAMBOAT SPRINGS, COL.—The Steamboat Springs Service Co. expects to purchase the usual number of incandescent lamps and a few electrical heating and cooking devices. W. L. Carver is superintendent.

TRINIDAD, COL.—The Trinidad El. Trans., Ry. & Gas Co. may install a series tungsten street-lighting system, consisting of from 50 to 60 lamps, in Walsenburg. The company expects to purchase within the next 12 months electrical devices, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. Franklin P. Wood is general manager.

YUMA, COL.—The town of Yuma is contemplating calling a special election to vote on a bond issue of $10,000, the proceeds to be used for the installation of a municipal electric-light plant.

PORTALES, N. M.—The Portales Utilities Co. is contemplating extensions and improvements to its central power plant and next year will add about 25 new wells to those which it now furnishes with electricity. About 30 miles of transmission lines will be erected. A. A. Rogers is president.

Canada

CALGARY, ALTA.—The Eau Claire Lumber Co., it is reported, has decided to increase the output of its power plant and will install two gas-driven electrical generating units, with a rating of 1500 kw, and two large turbines, to cost approximately $300,000. It is understood that the work will not be undertaken until spring.

VANCOUVER, B. C.—The British Pacific Pwr. Co., Bank of Ottawa Building, Vancouver, has applied for water rights on the Upper Powell Lake and on Powell River.

VANCOUVER, B. C.—The Council of Saanich is considering the installation of an electric-light system, to cost about $38,000, to be installed by the British Columbia El. Ry. Co., of Vancouver.

FREDERICTON, N. B.—The Eal River Lt., Ht. & Pwr. Co. has submitted a proposal to the City Council offering to furnish electricity for public services on a long-term contract at 2 cents per kw-hr. Messrs. Andrews and Murchie, of St. Stephen, and R. G. Lee, of Fredericton, are interested in the company.

NEWCASTLE, N. B.—We are informed that no improvements are contemplated at the municipal electric-light plant at present, as reported in the issue of Nov. 8. J. E. Lindon is town clerk.

SYDNEY, N. S.—The Cape Breton El. Co., Ltd., of Sydney, is installing a 300-kw motor-generator set, which is being installed in the Sydney station. Earle L. Milliken is manager.

CHATHAM, ONT.—The City Council has practically decided to purchase the gas and electric plant of the Chatham Gas Co. for $410,000. The company offered to sell the electric end of the business for $191,000. The city will use hydroelectric power.

FORT WILLIAM, ONT.—Among the by-laws to be submitted to the voters on election day is one calling for $125,000 for telephone purposes, one appropriating $115,000 for electric-lighting purposes, and one for street railway purposes carrying $238,000.

HAWKESBURY, ONT.—The Hawkesbury El. Lt. & Pwr. Co. is now constructing a power-house at Bell Falls on Rouge River, Quebec, to develop 4,000 hp and a transmission line to Hawkesbury, a distance of 13 miles. Contracts have been placed for waterwheels, generators and switching equipment. It is expected to have the plant in operation within eight months. James Ross is secretary.

OTTAWA, ONT.—Bids will be received by R. C. Desrochers, secretary Department of Public Works, Ottawa, until Jan. 15, for 10 knots of gutta-percha cable with four conductors, and 14 knots of gutta-percha with two conductors, to be delivered at Halifax, N. S., or St. John, N. B., by the first of May. Specifications and forms of tender may be obtained on application to the office of the general superintendent of the Government Telegraph Service, at the Department of Public Works, Ottawa.

PORT ARTHUR, ONT.—By-laws will be submitted to the ratepayers in January asking for an appropriation of $8,000 for extending the street-lighting system, $55,000 for extensions to the electric power system, $35,000 for improvements to telephone system, and $35,000 for street railways.

WALKERVILLE, ONT.—The ratepayers on Dec. 6 approved two by-laws relative to the adoption of hydroelectric power, one authorizing the town to enter into a contract with the Ontario Hydro-electric Commission for electricity generated at Niagara Falls and the other providing for an issue of debentures to cover the cost of constructing a distribution system.

DAVIDSON, SASK.—The town of Davidson is planning to install a small gas-electric equipment for lighting purposes. Contracts have already been placed for the machinery.

ESTEVAN, SASK.—Application has been made to the Saskatchewan Legislature for a charter for the Estevan Transit & Pwr. Co. for the purpose of developing power and building railways. The provisional directors are H. J. McNeil, W. J. Perkins, E. C. Hillborn and D. C. Dunbar, of Estevan.

Mexico

MAZATLAN, SINALOA, MEX.—The Empresa de Corriente Electrica, S. A., of Mazatlan, expects to install within the next two months a 165 hp to 185-hp gas engine with gas producer and a 120-kw, two-phase, 60 cycle Westinghouse generator. Equipment has already been purchased. Arthur de Cima is director-general.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Dec. 30, for copper condenser tubes, galvanized conduit, calcium carbide, etc. Blank and general information relating to this circular (No. 813) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

New Incorporations

ARKADELPHIA, ARK.—The Arkansas Pwr. Co. has been incorporated with a capital stock of $500,000 for the purpose of constructing and operating hydroelectric power plants in Arkadelphia, Malvern and other places. The officers of the company are: H. C. Couch, president; J. H. Meek, vice-president; J. W. Lee, treasurer, and J. L. Longino, secretary.

EARL, ARK.—The Crittenden Pwr. Co. has been incorporated with a capital stock of $15,000. The officers are: John F. Rhodes, president; H. A. Morrison, vice-president and treasurer, and J. B. McMillon, secretary.

DOVER, DEL.—A charter has been filed with the State Department for the Aux Cayes & Jeremie El. Ltg. Co., of New York, N. Y. The company is capitalized at $1,000,000 and proposes to construct and operate electric-lighting plants and systems in Aux Cayes and Jeremie in the Republic of Haiti. The incorporators are: Louis Durand, of New York, N. Y.; Hiram O. Hance, of Plainfield, N. J., and John S. Price, of Bellevue, N. J.

CHICAGO, ILL.—The Tyrone El. Co. has been incorporated with a capital stock of $100,000 by A. A. Rolf, Alvin E. Stein and George E. Paterson. The company proposes to generate and distribute electricity for lamps, heat and motors.

AUGUSTA, MAINE.—Articles of incorporation have been filed for the Consumers' General Service Co. with a capital stock of $250,000. The company proposes to construct, equip, operate, develop and control public utilities, including railways, water, electric and other utilities. R. S. Buzzell is president and L. J. Coleman is treasurer, both of Augusta.

BROOKFIELD, N. Y.—The Brookfield El. Lt. & Pwr Co. has been incorporated with a capital stock of $2,500 by William Welch, Charles H. Brown and Edgar Harris, of Brookfield.

WINNIPEG, MAN.—The Winnipeg River Pwr. Co. has been incorporated with a capital stock of $1,000,000 by E. Firth, C. W. Campbell, A. P. Scott, E. Beadie and R. Siderfin, of Winnipeg. The company will undertake the development work at the Big Bonnet Falls on the Winnipeg River, the rights to which were recently assigned to Sir William Whyte. The Winnipeg El. Ry. Co. will take the entire output of the plant. The distance of the proposed plant from the present plant of the railway company is 12 miles. The J. G. White Co., Inc., of New York, N. Y., it is reported, has been awarded the contract for construction of the plant.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 9, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,080,535. CIRCUIT CONTROLLER FOR ELECTRIC SIGNS; F. C. Brodie, Moose Jaw, Saskatchewan, Canada. App. filed April 3, 1913. Contacts on rotary drum may be raised into operative contact-making position.

1,080,544. WIRELESS SIGNALING SYSTEM; C. D. Ehret, Ardmore, Pa. App. filed Dec. 7, 1903. Receiving conductor with condenser associated therewith as a wave-responsive device and a local source of fluctuating energy acting on the condenser.

1,080,563. ELECTRIC SWITCH; O. M. Knoblock, South Bend, Ind. App. filed July 11, 1912. An inclined boss on the switch base forces the pivoted switch blade against a contact plate.

1,080,583. ELECTRICAL APPARATUS; H. E. Reeve, New York, N. Y. App. filed Sept. 25, 1908. Duplex metallic diaphragm supports the lever, which passes into the closed contact chamber.

1,080,584. ELECTRICAL APPARATUS; H. E. Reeve, New York, N. Y. App. filed June 2, 1909. Transmitting lever pivoted to vibrate in the plane of the diaphragm which closes the contact chamber.

1,080,585. ELECTRICAL APPARATUS; H. E. Reeve, New York, N. Y. App. filed Dec. 1, 1910. Electromagnet and vibrator contacts removable from the casing as a unit.

1,080,587. MULTIPLE CONTROL OF ELECTRIC MOTORS; R. Richter, Grünau, Germany. App. filed April 9, 1912. For insuring that the single motors are loaded according to their outputs.

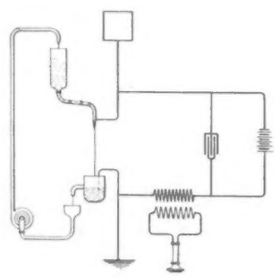
1,080,588. MULTIPLE CONTROL OF ELECTRIC MOTORS; R. Richter, Grünau, Germany. App. filed April 9, 1912. For controlling separately fed motors from one place.

1,080,589. VEHICLE SIGNAL; E. B. and G. E. Roedding, Detroit, Mich. App. filed May 19, 1913. Motor-operated rear-end auto signal.

1,080,605. INDUCTANCE COIL; F. G. Thackberry, Tampico, Ill. App. filed Aug. 7, 1912. Tuning coil with two sliding contacts.

1,080,611. LAMINATED CORE FOR ELECTRIC GENERATORS AND MOTORS; H. H. Wait, Chicago, Ill. App. filed Dec. 7, 1906. Certain of the laminas have projecting heat-radiating flanges.

1,080,667. ELECTRIC TOASTER; A. A. Warner, New Britain, Conn. App. filed May 20, 1912. Lower section of the heating unit is heated to a greater extent than the upper sections.



1,080,681—Wave Detector

1,080,681. WAVE DETECTOR; J. H. Cuntz, Hoboken, N. J. App. filed Oct. 1, 1903. Detecting means, including mercury in continuous circulation.

1,080,712. TROLLEY-WIRE CLAMP OR FASTENING DEVICE; G. A. Mead and F. S. Denneen, Mansfield, Ohio. App. filed July 19, 1909. A screw sleeve on the supporting rod forces clamp jaws against the trolley wire.

1,080,713. STRAIN INSULATOR; G. A. Mead and W. H. Kempton, Mansfield, Ohio. App. filed July 13, 1910. Shell contractible to clamp the insulating blocks therein.

1,080,730. CIRCUIT-CONTROLLING MECHANISM FOR ELECTRIC-RAILWAY SWITCHES; C. W. Squires, Beverly, Mass. App. filed July 25, 1911. For controlling circuits of electrically operated track switches by the person operating the car.

1,080,782. VARIABLE-SPEED MECHANISM FOR MOTOR VEHICLES; J. C. Riegel, Pottsville, Pa. App. filed Nov. 30, 1912. Electromagnetic coupling, including members in inductive relation, one fast to the prime mover and the other fast to the differential gearing of the motor car.

1,080,788. TIMER AND DISTRIBUTING DEVICE; J. M. Smith, Philadelphia, Pa. App. filed May 17, 1912. Novel construction of contact mounting for the make-and-break device.

1,080,807. ART OF MANUFACTURING STEEL; G. H. Benjamin, New York, N. Y. App. filed Jan. 4, 1913. Subjects purified iron and flux to effect of an electric current, introduces carbon and finally pours steel.

1,080,824. ELECTRICAL REDUCTION FURNACE; R. E. Frickey, Heroult, Cal. App. filed April 29, 1912. "Long and narrow" type of furnace for reduction of metals from their ores.

1,080,826. HEATING AND PURIFYING WATER; G. H. Gibson, Montclair, N. J. App. filed May 27, 1911. For boiler-feed purposes; treats condensate and raw make-up water with chemical, electrolyzes and filters.

1,080,830. ELECTRICAL COIL AND METHOD OF WINDING SAME; M. Helm, Berlin, Germany. App. filed Jan. 4, 1913. Wire laid in close coils in manner of "spool winding," and the insulating strands are laid with a diagonal or cross-wind.

1,080,840. ELECTRIC FURNACE; G. Massip, Levallois-Perret, France. App. filed Aug. 21, 1912. Tilting of the furnace or crucible brings the poles of the auxiliary arc into operative position.

1,080,852. STORAGE BATTERY; A. H. Snyder, Lancaster, and J. Starkenstein, New York, N. Y. App. filed Aug. 28, 1912. Means for lifting the plates without disturbing their relative operative positions.

1,080,862. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Resistor furnishes heat for producing metallic zinc fumes from oxide of zinc and carbon, fumes subsequently being condensed to liquid metal.

1,080,863. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Rod resistors with an interposed condenser adapted to receive the volatilized products.

1,080,864. ELECTRIC ZINC FURNACE WITH INTEGRAL COMPOUND CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Has plurality of condensing chambers.

1,080,865. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Bed of carbon reaction resistor, carbon filter bed and a bath of molten metal, all contained in a common chamber.

1,080,866. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913 Carbon resistor adapted to act either by conducted heat or radiated heat or both upon charge material disposed along the vertical sides of the resistor.

1,080,871. ELECTRIC SWITCH; J. N. Wallace, La Crosse, Wis. App. filed Feb. 15, 1910. For telephone circuits; has frame plate with slidable plungers.

1,080,897. MANUFACTURE OF DOUBLE HELICAL METALLIC TUBING; H. J. Davies and T. A. Judge, Sheffield, England. App. filed Jan. 20, 1913. Welds inner and outer layers or strips on a line parallel with the junction of the outer coils.

1,080,908. THERMO-ELECTRIC SWITCH; H. Gillette, Chicago, Ill. App. filed Aug. 1, 1912. Double circuit, quick make and break.

1,080,912. METHOD OF ELECTRICALLY SMELTING VOLATILE METALS; W. McA. Johnson, Hartford, Conn. App. filed Jan. 17, 1911. Electrically heats the charge; conducts the volatile reaction products into contact heated to maximum conductivity; continuously replaces carbon and condenses metal.

1,080,947. CASING FOR RESISTANCES; A. W. Berresford, Milwaukee, Wis. App. filed July 10, 1909. Has a reflex ventilating flue.

1,080,988. BEAN ASSORTER; R. F. McWilliams, Barryton, Mich. App. filed April 3, 1912. Selenium cell affected by light reflected from the individual beans; controls an electromagnetic sorting chute.

1,081,022. ELECTRICAL SWITCH; O. L. Davis, Iowa City, Ia. App. filed July 14, 1913. Buttons which must be pushed in predetermined order to close circuit.

1,081,072. GUARD FOR SPRINGS; S. P. Wilbur, Pittsburgh, Pa. App. filed Dec. 23, 1909. Tensioning device for glowers of glower lamps.

1,081,084. DYNAMO-ELECTRIC MACHINE; V. G. Apple, Dayton, Ohio. App. filed Nov. 27, 1908. Self-governed generator for ignition systems.

1,081,090. ELECTRIC CONVERSION; S. Cabot, Brookline, Mass. App. filed Dec. 4, 1909. Apparatus for transforming low constant-potential direct current or alternating current to high-potential direct current or vice versa.

1,081,114. APPARATUS FOR HEATING LIQUIDS BY ELECTRICITY; J. von Hentzel, Zurich, Switzerland. App. filed Dec. 26, 1912. Vessel which contains the electrodes and the water path between the electrodes is connected direct in the pipe line.

1,081,119. SWITCH; A. W. Johnson, Holland, Mich. App. filed Dec. 20, 1912. Multiple-gap switch.

1,081,128. SWITCHING MECHANISM FOR TELEPHONE EXCHANGES; F. A. Lundquist, Chicago, Ill. App. filed Feb. 1, 1905. For automatic systems.

1,081,160. MULTIPLE-FUSE DEVICE; G. S. Shoupe and W. H. Palmer, Cleveland, Ohio. App. filed Dec. 20, 1912. Burned-out or mutilated fuse is automatically replaced.

1,081,164. SMELTING OR REFINING OF METALS AND THE LIKE IN CRUCIBLES; H. G. Solomon, London, England. App. filed April 9, 1912. Induction furnace applicable to the crucible process of making steel and steel alloys.

1,081,191. PROCESS FOR THE ELECTROLYTIC MANUFACTURE OF PERBORATES; K. Arndt, Charlottenburg, Germany. App. filed Dec. 30, 1912. Electrolyzes a borate solution to which has been added a soluble carbonate.

1,081,213. INCLOSED ELECTRIC FUSE; F. N. Conant, Newburyport, Mass. App. filed Feb. 28, 1910. Spring indicator to indicate blowing of fuse.

1,081,214. INCLOSED ELECTRIC FUSE; F. N. Conant, Newburyport, Mass. App. filed Jan. 2, 1912. Spring indicator.

1,081,233. ELECTRIC HEATING ELEMENT; D. Huntley, London, England. App. filed Feb. 8, 1913. Electric radiator stove.

1,081,260. DEVICE FOR ELECTROMAGNETIC SUSPENSION; H. Zoelly, Zurich, Switzerland. App. filed Oct. 29, 1912. Maintains an adjustable air space between the support and the magnet poles.

1,081,266. RESETTING CIRCUIT FOR ANNUNCIATORS; J. O. Cadieux, Meriden, Conn. App. filed Nov. 7, 1912. Special arrangement of calling or resetting magnets.

1,081,277. BATTERY ELECTRODE; J. J. Auringer, Cohoes, N. Y. App. filed Jan. 17, 1913. Electrolytic electrode having a body of gas carbon and a separate exposed body of retort carbon bonded to the gas carbon.

1,081,278. ELECTRIC BURGLAR ALARM; H. S. Bitting, Lancaster, Pa. App. filed Dec. 30, 1912. Gives continuous alarm when circuit is once tampered with, even though circuit is again restored.